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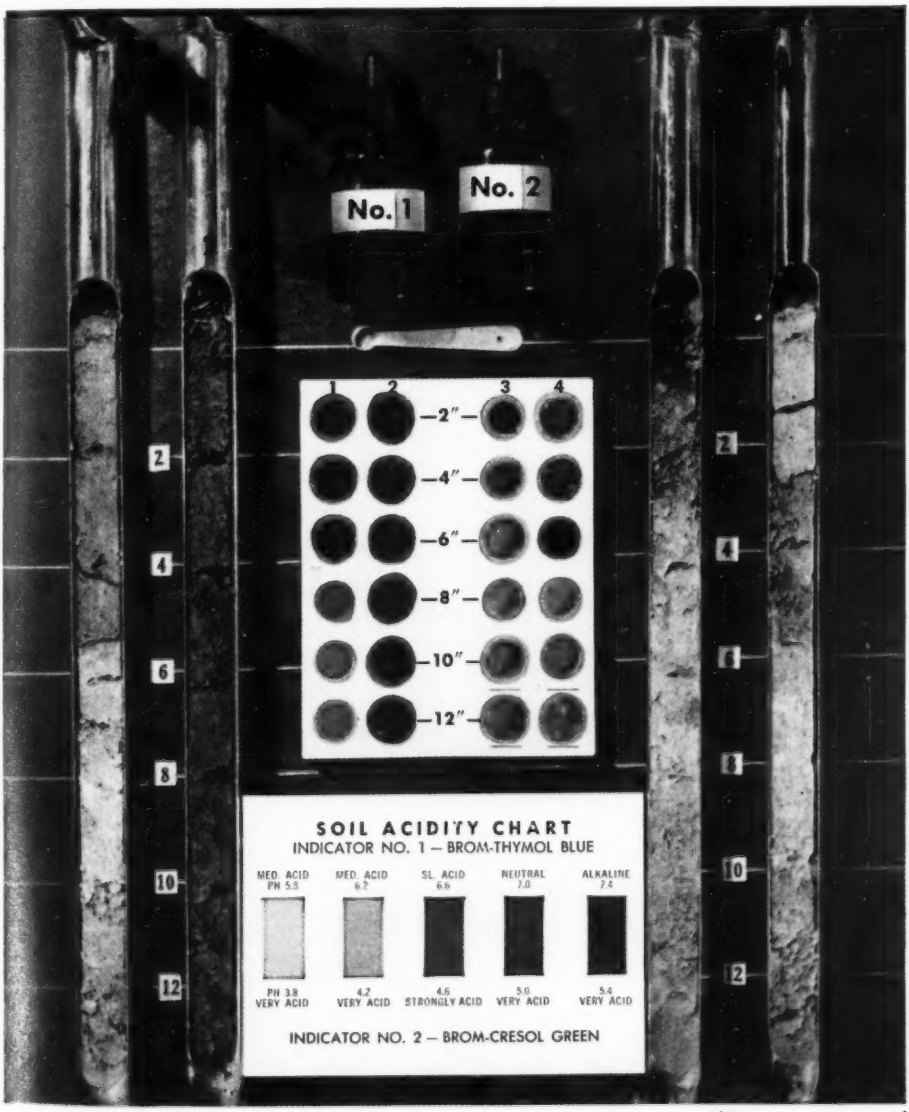

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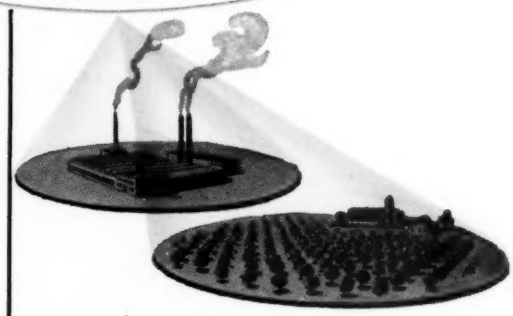

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R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVII NO. 5

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Waiting for Him to Finish the Chores

Better Crops with PLANT FOOD

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Editor's note: Twenty-six years ago in this magazine, Jeff had the following to say about "Science." While we never before have repeated one of his contributions, we are making this exception because of the present emphasis on agricultural research.

Science

Jeff McDermid

I LEARNED to respect science by unwittingly offending a Scientist. Having acquaintance with the science of fistology, and knowing how dearly the doctors of the Ph.D. (physiognomy destructive) degree court publicity, I supposed that the chemical laboratory would be equally anxious for fame.

I knew much about pugilism but little or nothing about metabolism. To make a sad story short, I invaded the realms of a Scientist who was later to become the father of the vitamin theory. My invasion came at an inopportune moment. I brought home the bacon, but I spilled the beans!

In a private lecture to a crass class of one, this solemn professor opened my eyes to the governing principle of pure science. He taught me that scareheads are not so precious to the scientist as conclusions at the end of a lengthy bibliography; that an ephemeral news story hath no such charm to him as a research bulletin with footnotes, asterisks, daggers, and tabulations; and that a select audience of understanding readers is more to be

courted than a big circulation of casuals.

He probably told me more, but I did not assimilate it. I lived through the ordeal, and he has probably forgiven and forgotten me; but out of the experience I came to see why the creation of the world is told so tersely in a few sentences. It was too strong for the reporters and too scientific for the circulation. I have read the popular treatise on it many times, but I don't know what they did with the original research bulletin!

Flippancy is resented by the laboratory, much as it may be admired by the laity. Fifty thousand solemn and sonorous words hermetically sealed in a library vault as a cornerstone document of achievement are worth more to pure science than a position on the "pictorial pink." It is better to molder with Copernicus than to share the matrix with Gene Tunney or Charlie Chaplin. To all of which I doff my derby. It's no sin to have an idiosyncrasy.

Though science grows fretfully impatient of the clumsy efforts of some well-meaning interpreters like myself, yet science as a profession must needs be very much the opposite. The man who posed for the proverbial "patience on a monument" was a scientist sitting on a pile of laboratory notebooks. Whenever I go past Rodin's statue of The Thinker in Philadelphia, I get the impression of a sort of cave-man scientist who is trying hard to find the answer to something above the din that his kids are making playing shinny with the dinosaur bones.

PATIENCE is bred by devotion and concentration. These are the handmaiden virtues that wait upon the scientist even as the wood nymphs once graced the bower of Apollo. They soothe his weary hours by crooning courageous sagas, and hold before him the tempting proffer of laurel-crowned reward—something like keeping the whippet racers going by dangling ahead of them a piece of bologna on a stick!

If patience, devotion, and concentration did not exist in the human spirit, the race of mankind would still be gibbering in the jungle.

The challenge of the puzzle appeals to human nature. From the nursery to the laboratory, the unsolved riddles of the world bring out all of the patience, devotion, and concentration that is in us.

TRUE science plays the game for the game's sake. The Curies, husband and wife, partners in poverty, working in a little shed with crude apparatus, extracted from the despised pitchblende of France a substance which is now worth $7,000 a gram. Ben Franklin snatched the thunderbolt from heaven with a child's kite and a door key. Charles Darwin, working out his theory of natural selection, came finally into loggerheads with orthodoxy. Monsier Pasteur, in saving the life of a little Alsatian peasant boy who was bitten by a rabid hound, evolved the great theory and practice of inoculation. Michael Pupin, Serbian farmer boy landing in America with a nickel in his pocket, has become a distinguished contributor to the field of electro-mechanics at Columbia University. Father Mendel, parish priest, humble gardener, and flower lover, established a law which is fundamental in eugenics and biology today. Justus von Liebig at Giessen and Sir John Lawes at Rothamsted founded the "kindergarten" from which the modern school of soil science has graduated. John Richardson Young, struggling chemist of Maryland, began the first chapters of the

American science of foods and nutrition with his studies of gastric digestion. The energy tables of Henry P. Armsby, challenged a whole collegiate band of livestock professors to go him one or two better.

In most of such striking victories in the riddle solving business it is not so much brilliancy and flash that wins the goal as hard work and patience.

Wonderful things developed by science are only the product of the scientist's ability to wonder. The two words, "I wonder," are the spark that sets the tinder of progress ablaze. Those who wonder over unknown things are those who have simplicity of spirit.

Simplicity is the first great attribute of the pure scientist. I have known Dr. Stephen Moulton Babcock for many years, and the thing that strikes me most winningly about that beloved old gentleman who invented the world's standard dairy test is his child-like simplicity and the gentle inquisitiveness of his mannerism. He wondered why the milk of a certain cow did not respond to his first attempts to perfect the butterfat test with sulphuric acid, and it was this persistent wondering of his that led to the final victory.

This unquenchable wonder inhabiting the brain cells of such devoted seekers after truth seems not to be lost with advancing years. Only a short while ago I found out that Dr. Babcock has been spending his years as an emeritus professor in a serious study of the atomic theory in physics, and has compiled a research volume on matters akin to this subject. Reward, plaudits, and world-wide fame mean absolutely nothing whatever to men like him.

The preservation and advancement of organized knowledge are not only dependent upon man's ability to wonder, but upon his power to question and his capacity to apply. Science is made up, then, of thinkers, workers, and practitioners. But all thinkers and workers are not scientists.

Most of us every-day workers and thinkers accept things for granted. We are not scientists. I pound on my portable typewriter without giving it a single thought until it sticks or sputters. Back of that little machine that I can carry in one hand lies a vast amount of the science of physics, the science of metallurgy, and perhaps of chemistry. The invention of it alone may have been a piece of mechanical ingenuity, but it could never have become a practical possibility without science.

THE engineer knows *how,* but the scientist wants to know *why.* The builder is a *doer,* but the scientist is a *dreamer.* The materialist deals in *fact,* but the scientist lives upon *faith.* St. Paul must have had something of the scientist in him, for does he not define faith as "the substance of things hoped for, the evidence of things not seen?" The true scientist's faith is not that of the alchemist or the necromancer, but the controlled fire of the calm zealot bent upon charting everything from a comet to the hatching of an egg. As some one has said, "Only genius can create science, but the humblest man can be taught its spirit. He can learn to face the truth."

This teaching of the spirit, this translation of science to the terms of the untaught commoner who may in time accept and gladly and unthinkingly *apply* the substance of the *faith* and realize the *dream* created in the mind of the true scientist, this job is a big one.

(*Turn to page* 50)

More Cotton on Less Land

By H. B. Vanderford

Agronomy Department, Mississippi State College, State College, Mississippi

Fig. 1. Land selection is an important step in the production of high yields of cotton. Deep, moderately well to well-drained, medium-in-texture loams, fine sandy loams, and silt loams on level to gently rolling slopes have the capacity to use efficiently large quantities of fertilizers and produce high yields of cotton. (Courtesy of Dr. O. T. Osgood.)

MANY developments and changes have taken place in Southern agriculture during the last decade, and cotton has lost some glamor but none of its importance. The publicity recently given to other enterprises such as grassland farming has left the "white-gold" crop playing a silent role of a wealthy "grandma" in Dixie agriculture. This fact is realized when one considers the percentage of the total farm income received from cotton in most of the states in the Cotton Belt. However, it is extremely difficult to make the grand old lady of the family as glamorous as the young bathing beauty member, regardless of the bathing suits available.

Some people in their zeal to promote other crops and land uses have accused cotton of being harmful or an enemy to Southern farms. In reality cotton per se has done no harm. The people trying to grow it have done plenty of harm to many acres by planting it on land that was never suited for profitable cotton production. In such a case the people and not the crop should be given the blame for all the soil depletion and erosion common in the old cotton fields throughout the South. A little thought on proper land use several years ago might have prevented cotton from being planted on much of the land in the first place. As a crop it has always performed as well as the soil on which it was planted and the management practices would permit. Therefore, the better the land and the management practices used, the more efficiently cotton can be produced per unit of land. This has also been realized for other land uses and has helped people to envision the opportunities available in Southern agriculture.

Farmers all over the Southland are getting accustomed to reducing acres planted to certain major crops without reducing the total production of bales, bushels, tons, etc. In the case of cotton production the recent trend has been for farmers to concentrate the cotton on the land that is best suited for it and the acres released have been found to be well suited for other crops. This is a part of the wise land-use movement and consequently more ef-

TABLE I.—COTTON ACREAGE AND PRODUCTION IN 10 SOUTHERN STATES FOR THE 1928-32 PERIOD. (FROM AGRICULTURAL STATISTICS 1936)

State	Av. acreage	Lbs. of lint per acre	Bales produced
Alabama	3,373,000	172	1,255,000
Arkansas	3,382,000	188	1,352,000
Georgia	3,166,000	176	1,241,000
Louisiana	1,847,000	192	745,000
Mississippi	3,977,000	191	1,559,000
North Carolina	1,432,000	269	752,000
Oklahoma	3,707,000	149	1,109,000
South Carolina	1,879,000	208	856,000
Tennessee	1,065,000	197	479,000
Texas	15,598,000	139	4,580,000

ficient farm production. More production per unit of land has emphasized the need for more nitrogen, phosphorus, potash, and lime on each farm, and this has meant a higher income for the farmer.

The acreage reduction program in the early thirties gave the farm people of the Cotton Belt their first great stimulation toward more efficient production and better land-use practices. It was perfectly natural for farmers who were faced with the demand from the Federal Government to plow up or reduce the acres in cotton, to remove those acres which had been producing the least. Then more fertilizer, better insect control, and better management practices were applied to the land that was originally well suited for cotton production. These changes, as would be expected, resulted in a higher production per unit of land planted in cotton. The reduction in acreage of cotton made more land available on the farms for pastures, seed crops, hays, trees, etc.

The trend throughout the Cotton Belt to produce more cotton on less land can be seen from the data in Tables I and II. In Arkansas, Mississippi, and Tennessee the picture is quite striking. In these states about one-half of the land that had been planted during 1928-32 was planted to cotton during 1941-50. And yet more cotton was produced than during 1928-32. During the period 1928-32 the farmers of Mississippi produced 1,559,000 bales of cotton on 3,977,000 acres.

TABLE II.—COTTON ACREAGE AND PRODUCTION IN 10 SOUTHERN STATES FOR THE 1941-50 PERIOD. (FROM 1952 PRODUCTION SUMMARY)

State	Av. acreage	Lbs. of lint per acre	Bales produced
Alabama	1,570,000	299	899,000
Arkansas	1,941,000	295	1,373,000
Georgia	1,409,000	317	686,000
Louisiana	862,000	391	524,000
Mississippi	2,372,000	329	1,652,000
North Carolina	728,000	376	523,000
Oklahoma	1,272,000	150	455,000
South Carolina	1,071,000	389	651,000
Tennessee	707,000	334	549,000
Texas	7,706,000	166	3,020,000

TABLE III.—FARM MARKET INCOMES FOR 1951 OF FOUR SOUTHERN STATES

State	Total cash income	From crops	Livestock	From cotton
Alabama	444,185,000	265,028,000	179,157,000	177,865,000
Arkansas	569,286,000	362,827,000	206,441,000	252,911,000
Louisiana	381,448,000	263,048,000	118,400,000	149,990,000
Mississippi	549,894,000	385,237,000	164,657,000	329,441,000

The average yield per acre was 191 lbs. of lint cotton. After the acreage reduction the 10-year average production for the 1941-50 period was 1,652,000 bales on 2,372,000 acres or an average of 329 lbs. of lint per acre.

The farm income received by farmers from cotton is still high in comparison with other crops and important in many states in spite of the fact that the acreage planted to this crop has been reduced several times. In Table III some data show the farm income from cotton along with the total farm market income, the income from all crops, and that from livestock. These data were taken from the report of the U. S. Department of Agriculture for the year 1951.

The important role that cotton plays in the farm income picture can be seen from the data presented in Table III for the four states listed. It is the most important cash crop grown in these states and will probably continue to be for some time to come. The important point is that in all of them the acres now planted in cotton can be reduced considerably and the production in income figures can remain as high as at the present time. This would enable the farmers to obtain more income from other crops and livestock and livestock products. This, of course, would tend to increase the total farm income and emphasize the value of better land use on the farms.

The year 1952 was considered a near disaster year by some in the State of Mississippi. The year 1951 was con-

Fig. 2. Young, well-fertilized cotton growing on a deep, well-drained soil which also has a favorable slope.

Fig. 3. A complete pest control program is necessary throughout the growing season to get the full benefit of the plant nutrients in or added to the soil. (Mississippi Extension Service Photo.)

sidered average for the farmers. Yet the farm market income was $609,648,000 in 1952 as compared with $549,894,000 in 1951. This increase in farm market income was largely due to the much better than expected cotton crop all over the State. The prices which the farmers received for cotton in 1952 were much lower than the prices received during 1951.

How Much Will the Soils Produce

The maximum crop yields that different soils are capable of producing present a very important and old problem, but little research has been initiated with this as a major objective. Our ideas on the productive capacities of the predominant soils have changed with the passing of time, and future research may modify them still more.

All soils are endowed by the factors of soil formation with capacities to produce certain quantities of adapted crops. They also inherit capacities to efficiently use definite amounts of fertilizers in different uses. These materials do not destroy nor equalize the inherited productive capacity of a soil on which they are applied. The soil particles must hold and deliver the plant nutrients into growing crops. It has also been observed for a long time that highly productive soils can often use more commercial fertilizer than can the low-producing soils. This leads our attention to the wise use of fertilizers and fertilizer materials which is a vital part of efficient crop production per unit of land. In other words, it seems more logical to think of giving each soil condition the amount of fertilizer that can be efficiently used for the production of cotton, corn, pasture, forage, etc., rather than following some thumb rule for record yields which completely ignores the capacity of the soil.

During the last four years many farmers from all sections of the State of Mississippi have produced as much as 3 to 3½ bales of cotton per acre on several acres. In every case the farmer started by putting the cotton on deep, fairly-well to well-drained, moist soils which were on level to gently rolling slopes. The plant nutrients were applied according to the capacity of the land to use them, and the insects which damage cotton were

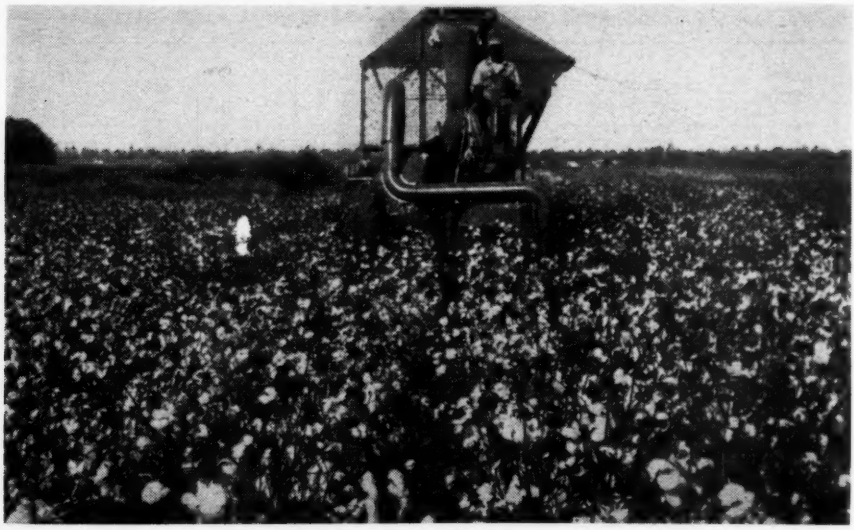

Fig. 4. Heavy fertilization on a suitable soil along with good pest control helped produce about three bales of cotton per acre on this farm.

controlled. All of these, along with other good management practices, have resulted in some remarkably high yields of cotton. Since these yields have been reported, many farmers are pondering over the question—"How much will the soils produce under the best conditions that man is able to provide?"

The Five-Acre Cotton Contest

In 1949 the Mississippi Extension Service, under the leadership of T. M. Waller, Specialist in Cotton Production, initiated a cotton-producing contest among the farmers of the State. One of the objectives was to find out how much cotton could be produced on any one five-acre block of land. A number of prizes were offered for the farmers who produced the most cotton per acre or on the five-acre block. This immediately stimulated interest and many farmers were certified to enter the contest the first year.

The rules of the contest were liberal and farmers entering were free to use any and all practices which they thought would help produce more cotton. Yields produced the first time surprised everybody, even the people who started the contest. More farmers have entered the contest every year since 1949 and the average yields are shown in Table IV along with the average yields per acre for the State.

The farmers in Mississippi who entered the five-acre contest produced a general average of 687 pounds of lint

TABLE IV.—AVERAGE PRODUCTION OF LINT COTTON PER ACRE IN MISSISSIPPI

Farmers	Years			
	1949	1950	1951	1952
Average for 5-acre contestants	687	730	853	900
Average for State	258	316	329	380

Fig. 5. Bales of "white gold" will soon be picked up from the shipping yard.

cotton per acre in 1949. The average yield figure has increased each year since, and in 1952 it was 900 pounds of lint cotton per acre. The average yield for all the farmers in the State was 258 pounds of lint per acre in 1949, and 380 pounds of lint per acre in 1952. The three district winners among the five-acre contestants produced yields of 1,778, 1,408, and 1,260 pounds of lint per acre respectively in 1952.

The State winner was H. S. Swayze of Yazoo County who used a field in which the soil was Collins silt loam. This is a deep, moderately well-drained, bottomland soil which occurs in the deep Loess Section or Brown Loam soil area of Mississippi and other Southern

Fig. 6. Shallow soils which are extremely high and dry have low capacities for cotton production. On the other hand, sericea lespedeza is well adapted for this kind of land. (Courtesy of Dr. O T. Osgood.)

states. Some field fertility tests which were conducted by the Experiment Station on this farm had indicated that this soil condition needed potash and phosphorus along with nitrogen for high cotton yields.

During the latter part of January, Mr. Swayze sent soil samples from his five-acre field, which already was in good condition for cotton production, to the Soil Testing Laboratory at State College for analyses and recommendations. He also indicated his desire to use this field as his patch in the State five-acre cotton contest. L. E. Gholston, after testing the soil samples and studying the history of the field, suggested the following treatments:

1. A heavy application of farmyard manure mixed well into the soil.
2. 1,200 pounds of 8-8-8 per acre or its equivalent, broadcast and also mixed thoroughly with the soil.
3. 900-1,000 pounds of 8-8-8, or its equivalent, applied deep in the drill at planting time.
4. 48 pounds of nitrogen applied to the cotton as a sidedress.

In terms of actual plant nutrients, it is interesting to note that these treatments would apply about 240 pounds nitrogen, 185 pounds P_2O_5, and 195 pounds of K_2O per acre. This is assuming that two tons of manure would be used per acre.

Mr. Swayze applied 218 pounds of nitrogen, 174 pounds of P_2O_5, and 184 pounds of K_2O, along with one ton of dolomitic lime per acre. He estimated these materials and applications cost $62.00 per acre. After applying these quantities of plant nutrients it was certainly wise to control boll-weevils and other pests. This was done and the poisoning program cost $21.90 per acre. In addition to supplying plant nutrients to a soil capable of using them and controlling the harmful insects, some supplemental irrigation was also used during the extremely dry growing season. The final and interesting result was that a total production of 8,890 pounds of lint cotton was harvested by this young farmer on five acres of land and this resulted in a gross income of $824.60 per acre.

Another contestant who won a State award was Harris Barnes, Jr. of Coahoma County. He selected a field that contained deep, fairly well-drained Delta loam soils. The soil survey map showed Dundee loam and Souva loam in this field. Experimental tests conducted by the Delta Branch Experiment Station on similar soils indicated that nitrogen was the main plant needed for cotton production.

Mr. Barnes began by planting his field in vetch in the fall of 1951. A good green manure crop was produced and turned under early in the spring of 1952 before planting time. It is difficult to estimate the pounds of nitrogen added by way of the green manure crop. In addition, 80 pounds of nitrogen were applied prior to planting the cotton. After the cotton was worked out and growing, 40 pounds of nitrogen were applied as a sidedress. If we assume that the vetch crop supplied 40-50 pounds of available nitrogen, this field received approximately 160-170 pounds of nitrogen per acre.

After adding the plant nutrients for high cotton yields, Mr. Barnes practiced a complete insect and weed control program. He made a total of 17 applications of poison in controlling the boll-weevils and other harmful insects. As a result of his efforts, this young man harvested 7,041 pounds of lint cotton on five acres of land which brought him a gross income of $720.64 per acre.

Yields Governed by Soils and Insect Control

A person is naturally inclined to wonder how much cotton can be produced on a limited number of selected fields as well as how much the farmers

(*Turn to page* 44)

Fig. 1. Birdsfoot trefoil is water-tolerant. Here it is growing along a diversion ditch in heavy clay. From late October to May this ditch is usually flooded.

Trefoil Is Different[1]

By K. E. Varney

Agronomy Department, University of Vermont, Burlington, Vermont

AROUND 1940 a new legume, birdsfoot trefoil, was introduced to the Vermont farmer. Five-pound lots of seed, enough for 1-acre plantings, were distributed among some 70 farmers throughout the 14 counties of the State. To them it was just another legume, and so they planted and managed it like red clover, alfalfa, or ladino. A few of these seedings were very successful; most were failures or, at best, near failures. The Vermont Experiment Station became interested in the plant and has done considerable work with it since. As we became more and more familiar with trefoil, one fact was soon evident—*trefoil is different.* Since alfalfa, ladino, and red clover are familiar to all, they will serve as a comparison in this discussion of differences.

Trefoil, Both Drouth-resistant and Water-tolerant

Alfalfa is a deep-rooted, drouth-resistant plant and will not tolerate wet feet. Its adaptation to well-drained soils is frequently observed on a sloping site where the stand is good on the upper slopes but thins out and finally disappears in the hollows or where water accumulates.

Ladino is a creeping plant. Its stem grows along the ground, and roots are formed all along the stem at the nodes. Thus ladino is a shallow-rooted plant.

[1] Vermont Agricultural Experiment Station Journal Series Paper No. 33.

It does best on moisture-retaining soils and is very susceptible to drouth.

Trefoil is different. It has a tap root like alfalfa though not as long, and the root tends to branch out more. Unlike ladino, trefoil is very drouth-resistant, being equal or even superior to alfalfa in this respect. Unlike alfalfa, trefoil is very tolerant of wet feet. In fact, on the heavy clay soils of Addison County, localized low spots in a stand of trefoil may be covered with standing water for a month or two in late winter or early spring. These flooded areas survive nicely and at times it seems as though these sections of the field come through the winter in better condition than the rest of the field. Especially is this true in a season when frost heaving is bad. Heaving is much less severe in these very low, wet areas.

Trefoil Requires A Special Inoculum

Alfalfa, wild white clover, and red clover have been grown in this area for a great many years. Our soils are well populated with the bacteria, called *Rhizobia,* that are essential to the growth of these three legumes. Alfalfa *Rhizobia* are also "at home" on sweet clover and black medic, while ladino *Rhizobia* live on red, white, and crimson clover and other members of the *Trifolium* group of legumes. Although inoculation of the seed of these legumes at planting time is very desirable, failure to do so would probably not seriously affect the stand. The chances are good that most of the seedlings would be inoculated by bacteria already present in the soil.

Trefoil is different. It requires a specific species of Rhizobium—one that does not occur on any of the legumes growing in this area. Since trefoil is new, our soils are completely lacking in this trefoil bacterium. Failure to provide an adequate supply of inoculum at seeding time will almost invariably result in poor, yellowish stands.

Trefoil, a Slow Starter

Alfalfa, red clover, and ladino grow rather rapidly in the seedling stage. They are thus better able to compete with oats, which are most often seeded with them, and with weeds. Successful first-year stands of these legumes are relatively easy to obtain, even under conditions of poor management.

Trefoil is different. It is a notoriously "slow starter" unless conditions are about right for it. Being a slow starter, the more rapidly growing plants such as oats and weeds will give it serious competition, unless properly managed by clipping or grazing the first year.

Trefoil, a Triple Purpose Plant

Although both alfalfa and ladino are used for hay, silage, and pasture, alfalfa is normally thought of as a hay-silage plant and ladino as primarily a silage-pasture plant. Red clover is most often considered as strictly a hay plant.

From the standpoint of yield, alfalfa is without equal. To produce good alfalfa hay it must be harvested at the proper stage. If cut on the late side it is usually woody and is often heavily diseased with leafspot. Both these conditions drastically cut down the feeding value of alfalfa hay. As a pasture plant alfalfa must be very carefully managed since close and constant grazing will almost certainly kill it.

As a pasture or silage plant, ladino is probably without equal when properly managed. It is high-yielding, has a very rapid comeback, but cannot tolerate constant grazing. It is a poor hay plant, being succulent and difficult to cure. Furthermore, it will not tolerate the shading of tall grasses at the hay stage and it is frequently lost by letting it go to the hay stage before harvesting.

Trefoil is different. It is good for hay, silage, and pasture. It does not get woody even if cutting should be

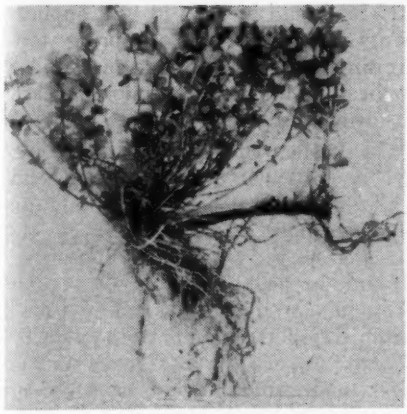

Fig. 2. New trefoil plants can come from broken roots. Here a root was severed and placed in soil in the greenhouse. Shoots developed at each end, giving rise to two new plants.

delayed until late summer or early fall. Neither does it lose its palatability when cut late, being quite different from red clover in this respect. Unlike alfalfa and red clover, it is relatively free from diseases—especially the leaf-spots which reduce their feeding value.

As a pasture plant, Empire trefoil can stand more abuse than almost any other legume. It can tolerate close and constant grazing and still maintain a stand, although such severe overgrazing is not recommended. Being drouth-resistant it provides better grazing than ladino clover during the hot months.

Trefoil Reseeds Itself

Alfalfa seldom sets seed in this area, and so stands are maintained by plowing and reseeding. If alfalfa or red clover were permitted to produce seed so as to reseed itself, it would be nearly worthless for forage because it would become woody and have dropped most of its leaves before seed is ripe.

Trefoil is different. When grazed as a pasture plant it will flower and set seed next to the ground and around ungrazed manure spots. If managed as hay and allowed to set seed, it will do so relatively early in the season and yet retain its value for hay—neither losing its leaves nor becoming woody.

Trefoil Never Causes Bloat

One problem confronting farmers who use alfalfa and ladino for pasture, especially in wet years, is that of bloat. Care must be taken to pre-feed with dry hay or to remove livestock before they can become bloated.

Trefoil is different. At present there has never been a case of bloat that could be attributed to trefoil.

Trefoil Is Long-lived

At one time alfalfa was considered a long-lived plant, and stands were sometimes maintained from 10 to 12 years. Today, through winter injury and disease, a 6-year stand is considered a good one. Ladino can be maintained for several years but again winter injury or poor management will probably take it out in a relatively short time.

Trefoil is different. Since it reseeds frequently and proficiently, a good established stand of trefoil can be maintained almost indefinitely. In fact, there is a native stand in Orwell, Vermont, that has persisted for 30 to 50 years in spite of the fact that the land has been abandoned for many years and is now reverting to pines and other trees.

On experimental plots in Addison County, where trefoil had been grown for eight years, a trefoil stand was disked quite thoroughly in late August. Winter wheat was sown in September and a good stand of wheat obtained. The following spring, a very thick stand of trefoil seedlings came in without adding trefoil seed and became well established by the time the wheat was harvested. Thus we were able to harvest a wheat crop and yet re-establish trefoil from seeds left on or in the ground from previous years.

Trefoil Can Propagate From Roots

When an alfalfa plant "heaves" as the result of alternate freezes and thaws,

the root is often broken off below the crown. The plant then dies, for it cannot send up new shoots from roots. The same is true of ladino.

Trefoil is different. If a trefoil root is broken it can produce new stems from the remaining root-piece. This may, in part, help to explain the longevity of trefoil on the heavier clay soils where "heaving" is so often prevalent.

As has been pointed out, *trefoil is different* and an understanding of these differences may help to overcome some of the difficulties encountered in the past in getting and maintaining a good stand. There are four principal steps to remember when establishing trefoil, namely:

1. Adequate fertility
2. Proper inoculation
3. Early planting
4. Minimum competition.

Adequate Fertility.

Unfortunately for trefoil, it was first called "poor man's alfalfa" and was credited with being adapted to soils too poor and too acid for alfalfa. It is true that trefoil will tolerate and grow on such soils but it will not thrive on them. In other words, "You can't get something for nothing." Before planting trefoil be sure that the soil is well limed and that the fertility level is up where it should be for any self-respecting, clover-like plant.

For optimum yields of trefoil, sufficient lime should be applied, prior to planting, to give a pH of from 6.0 to 6.8 and subsequent application made frequently enough to maintain this pH. A good rule to remember, as when growing any legume, is "adequate lime; superphosphate to get a stand; and potash to maintain a stand."

Potash is the key to higher yields, especially on the lighter soils. At time of seeding from 100-200 pounds of an 0-20-20 should be used. Following establishment, from 500-600 pounds per acre of an 0-20-20 or, better yet, an 0-15-30 should be used in split application, an annual fall or spring topdressing of 200-300 pounds and similar applications immediately following each cut or harvest.

On the heavier clay soils, where trefoil is particularly well adapted and where the natural potash level is quite high, greatest response has been obtained from the use of superphosphate. At time of seeding, up to 500 pounds per acre of straight super can be drilled with trefoil seed or from 100-200 pounds of an 0-20-20. Thereafter annual topdressings should be made of either superphosphate or an 0-20-20 at rates up to 400 to 600 pounds per acre. As with other legumes, a split application of this material is desirable.

Proper Inoculation.

Trefoil requires its own specific bacteria, a species distinct and different from that used for any other legume. Trefoil should NEVER be planted unless it has first been treated with this inoculum. The conventional method of inoculating is to moisten the seeds, sprinkle the inoculum from the can over them, mix and let dry somewhat before planting. If this method is used, up to four times the recommended inoculum should be applied. Trefoil seed are very round and smooth and do not retain the bacteria as easily as do other seed. Then, too, the bouncing of the seed drill as it is hauled over the seedbed tends to shake off much of the inoculum.

A much more effective method is to make a thick solution of clay and water to which is added the inoculum. This is poured over the seed and thoroughly mixed. When spread out, the seed dry quickly. The clay-inoculum mix coats the seed and each seed is thus assured of carrying many bacteria.

Another method is to add not over three tablespoons of molasses, or some other thick syrup, to each gallon (eight pounds) of seed. After mixing thoroughly, the inoculum is added and

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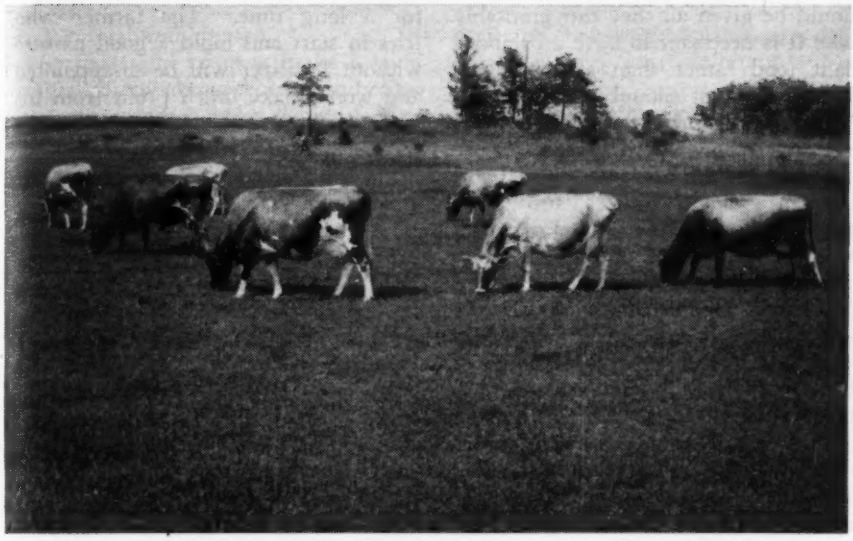

Fig. 1. These profitable dairy cows are finding good summer grazing on lespedeza.

Grassland Farming Is Planned Prosperity

By W. R. Thompson

Agronomy Department, Mississippi Agricultural Experiment Station, State College, Mississippi

GRASSLAND farming is planned prosperity. It is not new, but is being given new emphasis by agricultural agencies, farmers, and business men. This program takes in 60% of the area of the United States, about 1 billion acres of land. In the South, 50 million acres are affected. From a soil conservation standpoint there is no better program than pastures. With them, soil conservation becomes an opportunity in place of a problem.

Grassland farming is divided into several steps, each leading into another and all dependent on each other. First, is a plan or blueprint to work by. This is an outline and is made up of a soil map, soil testing, the fencing program, plants and combinations to plant, seasonal grazing to use, and enough land for the livestock wanted.

Next is the fertilizer. Food is the most necessary thing in animal or plant life. For pastures, it is the insurance that they will be good and will stay good. There is very little pasture land that will make good pastures without plant food. Lime, phosphate, potash, and nitrogen are needed. These must either be in the ground or applied. In fertilizing, more attention is being given to the needs of the plant or combination of plants. Different plants use different amounts of plant food and

should be given all they can profitably use. It is necessary to have a balanced plant food rather than a lot of one element and not enough of the others.

Some of the new findings on grass and clover show that many grasses use as much potash as phosphorus and nitrogen. Some grasses use more potash than phosphate. All clovers and legumes must have phosphate and potash in high amounts for excellent growth on land that has lime in it, or applied, to raise the pH to 6.0 to 6.5. Fescue uses as much potash as the clovers that grow with it and failure to recognize the potash needs of both is inviting failure of the combination. Coastal Bermuda uses twice as much potash as phosphate, calling for a mixture such as 8-8-16 or 10-10-20. Pasture plants are like motors and should be fed according to their ability to use plant food. If only a little plant food is given a high user, it won't move.

The first application of fertilizer will be much heavier than the next to maintain the good pasture, because pastures are nearly always started on poor soil or a soil that has been row-cropped for a long time. The farmer who tries to start and build a good pasture without fertilizer will be disappointed and won't make much profit from his labor. The farmer who fertilizes to start a pasture and then forgets or neglects to re-fertilize the next years will lose his good pastures. It has been found that $1 invested in fertilizer will bring a return of from $5 to $9 according to the pasture crop it is used on. Fertilizing pastures is an investment and not just an expense item.

Seeding is important for pastures to have what is wanted, where it is wanted, and when needed. There are enough plants for pastures on any farm in any area. Plants that grow the same season should be planted together. There are two kinds of plantings and combinations—perennials and annuals. Fescue and white Dutch or ladino clover make a good perennial combination. Dallis grass, Bermuda grass, and white clover form another good perennial combination. Dallis grass and lespedeza are good examples of a perennial and an annual which grow well together. Sericea lespedeza and crimson clover are a good perennial

Fig. 2. Well-fertilized white clover provides early spring grazing.

and annual combination.

Ryegrass and crimson make a good annual combination. Kudzu and crimson and ryegrass make an ideal combination for high, deep, rough land. For coastal plain sandy soil, Bahia grass and crimson are good. Coastal Bermuda grass with a clover or alone makes good grazing on Southern soils. All of these plants need placing on the farm by using the soil map and fertilizing.

Management is the secret to any pasture program. For example, fertilizer and seed are absolutely necessary on most pastures, but these two can be put into a pasture program and management left off and no profit will be made.

Management takes in, first, having enough land in pastures for the livestock on the farm and having some pasture areas for each season of growing weather. The mowing machine or clipper is a necessary tool. Bushes, weeds, and mature grass and clover must be kept off.

Turning livestock in on the different plants or combinations of plants at the right time is important. Taking them off before the plants are overgrazed is even more important. Overgrazing is the cause of more pasture failures than any other one practice, unless it is the failure to go back and re-fertilize the pastures after they are put in. The original plan should outline when each pasture will need another application of fertilizer and what kind of mixture to use.

The best heights to turn livestock on the different grazing crops are:

Oats, wheat, and other cereals—8 inches
Ryegrass—6 inches
Fescue—First grazing after planting —6 to 8 inches
—Established—6 to 8 inches
Clovers—5 to 6 inches
Dallis grass—when leaves are 6 inches long
Lespedeza—6 to 8 inches
Sericea lespedeza—8 to 10 inches (It gets tough and stemmy when higher).
Bermuda—4 to 6 inches.

A new weed control program being used in many Southern states is spraying with amine 2,4-D using 1 pound

Fig. 3. Pigs do well on pasture in summer.

Fig. 4. A good grass and clover mixture will help prevent bloat in cattle.

in 20 gallons of water per acre. On permanent pastures it is better to spray for the ordinary weeds the last of April and the last of July. Two applications per year will usually control most of the summer weeds on pastures except cypress weeds. The clipper or mowing machine will have to be used on them.

Where pastures are infested with dock and thistle, it is recommended they be sprayed with 2,4-D in November for the dock and again in March for the dock and thistle.

When onions infest pastures, spray in the fall with maleic hydrazide, using 4 gallons of soluble material in 20 gallons of water per acre and repeat in February or March when the onions regain growth.

One caution in spraying pastures is that plants such as Persian clover, hop clover, vetch, crimson clover, and winter peas are killed by 2,4-D, so on permanent pastures the spraying will have to be started after the grazing season for these plants has passed. Oftentimes it is desirable to rid certain fields or pastures of vetch or Persian clover. This is a good way to kill them. Amine 2,4-D will not kill lespedeza after it gets up and is well established. Neither will it kill white clover or any of our good grazing grasses.

Entomology is the pasture producer's protection from insects. If instructions are followed, no insect will eat the profits from pasture crops either in the grass and clover or from the livestock after they eat the pasture crops.

The feed program is a part of the grassland plan or blueprint. There are periods of the year in all areas when pastures are short. Hay, silage, corn, and small grain make up the feeds that can be grown. It is possible to plan for hay and silage in the pasture program. Whenever there is more grazing than needed, it can be put up as hay or silage. Many spring grazing crops can be followed by a silage crop of sorghum or corn. One of our big opportunities is to cut the extra grazing during the spring for silage and feed it out during the dry or winter periods.

Southern pasture management is divided into management of annuals or combinations of annuals and management of perennials and then combinations of perennials and in some

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Fertilizers Move West

By T. A. Kiesselbach

Agronomy Department, Nebraska College of Agriculture, Lincoln, Nebraska

OUT at the western edge of the Corn Belt, the State of Nebraska at last confesses a huge interest in the use of commercial fertilizers for crop production. Although a comparatively young agricultural state, the eastern third has recently completed the transition from adequate to deficient soil fertility, from unprofitable to profitable crop response to commercial fertilizer. In most of this area the first element of plant nutrition to have become deficient for normal growth of cereal crops is nitrogen. The native supply of phosphorus is holding out much better, as would be expected, but even this is running short of optimum in numerous localities. Potassium, third among the important plant-food elements that need replenishment sooner or later in the older farming regions of the country, is found to be plentiful except in restricted areas of this state.

To most persons who have been interested in farming for 50 or more years, this seems like a rapid and almost unbelievable change from the supposedly "inexhaustible virgin prairie soil." But 75 years of continued cropping with little return to the soil has done the trick. Now it is a well-demonstrated fact that millions of acres in the eastern third of Nebraska, and irrigated land elsewhere, will respond profitably to nitrogenous fertilizer applied to non-legume crops. On much of this same acreage, the increased yields of the legumes and even wheat and oats will more than pay for the cost of reasonable phosphate applications. The greatest response of the cereal crops is obtained when the phosphate is used in conjunction with nitrogenous fertilizer. Limited areas are distinctly phosphate-deficient and outstanding results are obtained from its use. Response to these fertilizers in central and western Nebraska is less pronounced and less certain because of more limited rainfall and a younger agriculture. It is ordinarily regarded as good management to withhold the use of fertilizers until the crops give a profitable response; but when that time comes it is poor economics not to use them.

Since we have been taught for many years that the forage legumes are capable of gathering nitrogen from the air and adding to the supply of soil nitrogen, it may seem a bit inconsistent not to depend entirely upon these legumes for maintaining this element. Such reliance in the legumes alone would be impracticable, because they do not occur often enough in the rotations that are followed on most farms to meet the nitrogen requirements. In a 6-year red clover or sweet-clover rotation for example, the legume may supply enough nitrogen for the first corn crop that follows, or for two crops at the most. The next three crops, be they oats, corn, or wheat, would be short of nitrogen if it is not artificially supplied. Thus, nitrogenous fertilizer becomes a supplementary and essential addition to the soil.

Furthermore, the growing of legumes helps in no way to maintain the supply of other soil fertility constituents as phosphorus, potassium, and calcium.

In so far as the legumes help to increase the yield of grain crops that follow and are removed from the land, the greater is the drain upon these other elements. The old adage applies: "One cannot eat his cake and have it too."

For the purpose of determining the regional responses of crops to fertilizer treatments, the Nebraska Agricultural Experiment Station maintains an Outstate Testing Project as a division of the Agronomy Department. Members of the staff locate representative farms distributed in many areas of the State and personally conduct all kinds of practical fertilizer experiments. The results of 4 to 7 years of such tests can now be summarized and these portray very well what may be expected on farms. Extension Agronomists also have numerous combination experimental and demonstration tests which are proving very convincing to the farmer as to what the proper use of fertilizers will do for him. A few results here presented will serve to indicate the extent of response that may be expected from fertilizers in most areas of eastern Nebraska.

Fertilizers on Corn in Eastern Nebraska

As an average for four years, involving 27 regional tests, the nonfertilized corn yielded 49 bushels per acre compared with 65 and 67 bushels in response to sidedressings of 40 and 80 pounds of nitrogen in the form of either ammonium nitrate or urea. These are increases of 16 and 18 bushels, respectively. Corresponding average yields during seven years under irrigation (17 tests) were 57, 81, and 86 bushels respectively, for 0-, 40-, and 80-pound applications of nitrogen. These are gains of 24 and 29 bushels for the respective rates. At a cost of $0.15 per pound of nitrogen contained in these fertilizers, 40-pound applications would cost $6.00 per acre. Thus at an outlay of $6.00 an acre for nitrogenous fertilizer, an increased income of $24 was obtained on dry land, and $36 greater income under irrigation, considering corn at $1.50 per bushel.

Forty pounds nitrogen applied as a sidedressing at either the second or third cultivation are regarded as normal for most non-irrigated fields that have not been manured or successfully cropped to a forage legume within two years. On thin soils in regions of favorable moisture, 60 pounds should not be excessive. Under adequate irrigation, more can be used profitably. Stands and fertility level should be adjusted to the moisture supply available. The corn should preferably be sidedressed with a cultivator fertilizer-attachment at a 2-inch depth, 8 to 10 inches from the row.

As a 4-year average, a 10-20-0 starter fertilizer applied at time of planting in addition to a sidedressing of 40 pounds nitrogen added only two bushels more than the sidedressing alone. Although the corn seedlings grew faster and this facilitated early weed control, the yield increase was inadequate to justify use of the additional starter fertilizer.

Ammonium nitrate, ammonium sulfate, and urea are equally effective nitrogen carriers for corn when applied in equivalent quantities of nitrogen. Anhydrous ammonia also is an effective carrier of nitrogen for corn when placed at a depth of 4 to 6 inches before planting or as a sidedressing. About equal results come from its use when applied prior to planting or at the second or third cultivation.

Lowrey and Rhoades of the Nebraska Station state, "Corn yields are not likely to be increased by the application of phosphorus and potassium fertilizers to most Nebraska soils; however, it is desirable to have the soil tested if a deficiency of either phosphorus or potassium for corn production is suspected. Where needed, phosphorus and potassium fertilizers should be applied at the rate of 20 to 40 pounds P_2O_5 per acre and 20 to 40

pounds K_2O per acre respectively." Such tests may be obtained for a small fee by sending representative soil samples, taken by recommended procedure, to the Soil Testing Laboratory.

When fertilizers are used in corn production, it is all the more important to exercise special care to obtain and maintain a full stand of plants. It is considered that normally the stand should be so dense that the average ear weight produced does not exceed about one-half pound when air-dry.

Fertilizers on Wheat in Eastern Nebraska

Outstate tests of commercial fertilizers on winter wheat during the six years 1947 to 1952, have established convincingly the profitable response to suitable applications of nitrogenous fertilizer in most areas of eastern Nebraska, and to a lesser extent also to additions of available phosphorus, especially in combination with nitrogen.

As an average for the six years, with a total of 27 experiments, early spring topdressing with 40 pounds nitrogen increased the wheat yield by seven bushels per acre. At $2.25 per bushel, this provides an added gross income of $15.75 for the expenditure of $6.00 for fertilizer. On the basis of experimental results, heavier applications are not recommended for wheat.

Ammonium nitrate and urea have proved to be the best carriers of nitrogen for topdressing wheat, especially if the soil is dry at the surface at time of application. Anhydrous ammonia also compares favorably with these when applied in bands 4 to 6 inches deep. Fall application of a starter fertilizer, consisting of 10 pounds nitrogen and 30 pounds P_2O_5 per acre, is regarded as having merit for improving stands and early growth on soils that are especially low in fertility.

The comparative merits of fall and spring fertilization with nitrogen have proved variable with the season. Either practice is approved. However, researchers Lowrey, Olson, Dreier, and Ehlers conclude that "on the basis of six years experimentation it is evident that spring treatments with nitrogen have a wider adaptation than have fall

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Fig. 1. Effect of sidedressing corn with 40 pounds nitrogen at second cultivation, following second-year sweetclover in a 6-year rotation on the Nebraska Agricultural Experiment Station farm, 1951. Left: 3 rows fertilized, yield 78.8 bushels per acre. Right: 3 rows not fertilized, yield 69 bushels. (Non-fertilized corn in a comparable 6-year straight grain rotation yielded 35.1 bushels.)

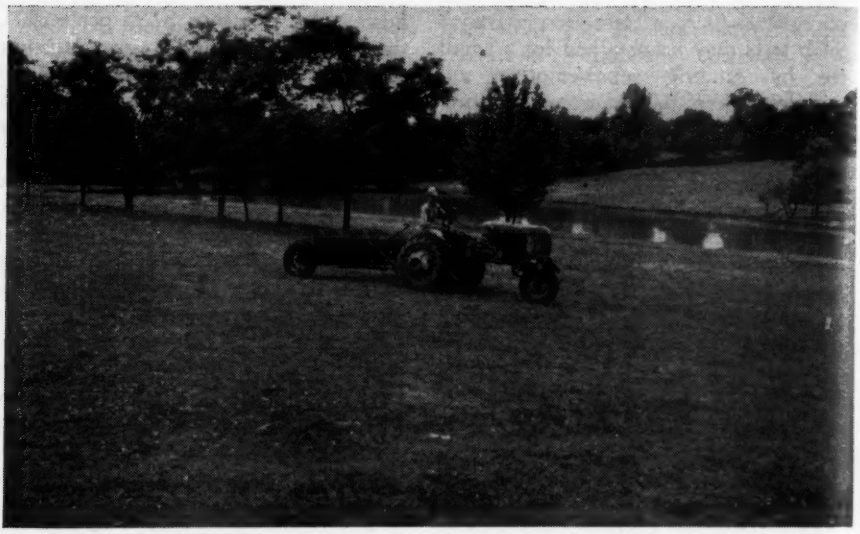


Fig. 1. The pasture above is managed for best returns—sufficient water, controlled grazing, good shade, weed control, and minerals applied every year.

Common Sense Management of Southern Pastures

By J. H. Brooks

Soil Conservation Service, Tupelo, Mississippi

IN most instances, the land selected by the farmer to be used for pasture is too steep, too flat, too wet, or too dry for ordinary field crops—so he has decided to use it for pasture and too often he thinks it should grow just any pasture plant well.

During the past year or two in which the major emphasis in agriculture has been on grassland farming, much has been written and spoken about pasture plants, pasture fertilization, and the number of cattle that can be carried per acre of pasture. Very little has been said about pasture management from the standpoint of the maximum net dollars per acre that can be realized by using properly adapted plants and fertilizing according to the need of the soils for the particular plants to be used. Nor has enough been said about the ability of particular soils to use fertilizer economically, or about grazing or harvesting.

When one goes out to assist a farmer in planning his pasture or grazing program in the hill section of Mississippi, or any other Southern state, he will likely find a soil condition varying from very steep, sandy upland to heavy, wet bottom land. He must work with the soil conditions he finds on the farm. The problem then is to plan an economically sound grazing program that will give good returns to the farmer for money spent on each acre of land

regardless of soil, slope, or erosion conditions.

It must be recognized that there are some areas on which it is not practical or economical to attempt to establish pastures, unless the proper soil-plant relationships are determined and only adapted plants are used as grazing crops. A thorough understanding of soil capabilities as well as the growth habits, food needs, and moisture requirements of the plants is necessary before these relationships can be accurately determined.

The main points to consider should be: First, the long-time protection of the soil and, second, the continual improvement of its ability to produce. This can only be done by first selecting the plants best adapted to each individual soil condition; then, by feeding the soil with the necessary mineral requirements, at intervals as needed, to give satisfactory plant growth; and, lastly, by carefully managing the grazing.

The State Soils Laboratory can best give the mineral requirements for any particular soil. But a physical soil survey will give the answer as to how often, what season of the year, and by what method these required minerals should be applied. It is known, for example, that on a waterlogged soil with very little organic content, the minerals should be applied at more frequent intervals and in smaller amounts than on well-drained loams or heavy clays having a good supply of organic matter. A heavy fall application of nitrogen on wet, poorly drained soil would probably prove a loss to the farmer, as field observations have shown that under these conditions most of the nitrogen is lost due to excessive water and very little grazing can be obtained from these wet areas during winter and spring months. General pasture recommendations do not take into consideration these and other similar factors that are found when a pasture is planned according to the land itself.

Any pasture plan offered a farmer must be practical and must make money for him if he is expected to

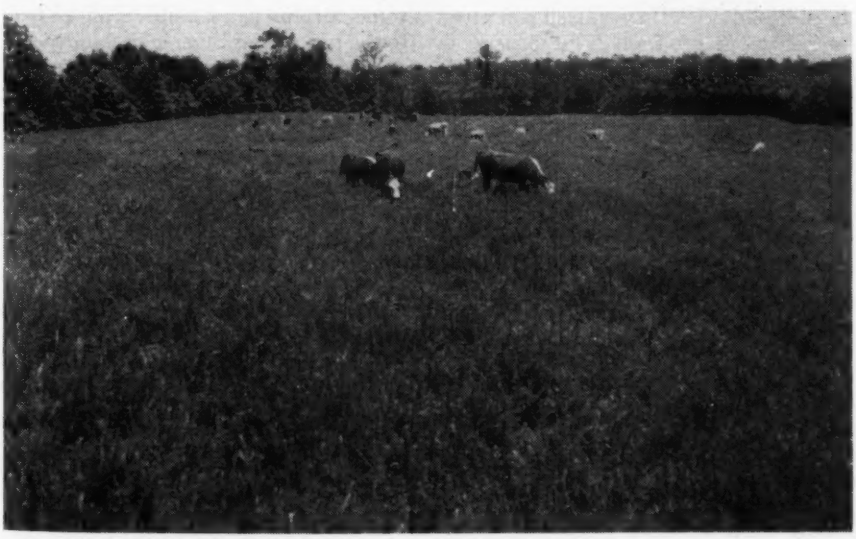


Fig. 2. Sericea provides good grazing and soil protection on Class VI Ruston Sandy Loam soil, which is very droughty and erosive. Poor grazing and erosion control result on this soil when planted to the ordinary pasture mixtures used in this area. This field receives an application of phosphate and potash each year. It is never allowed to be overgrazed.

follow it. It is easy to find the faults in any individual pasture or complete grazing program after it has been established and used for a time. Nature will help bring out the errors. The important thing is to avoid errors in the finished product by a thorough study of the soil's physical condition and its mineral requirements before the actual job of pasture building is undertaken.

After the soil has been properly mineralized according to its needs, the plants best adapted to each particular soil condition should be selected, keeping in mind the need for year-round grazing. Acreage adjustments of the various plants to be used will need to be made to provide seasonal grazing.

A wide variety of annual grasses, perennial grasses, and legumes are available from which selections can be made. The planner and the farmer, working together, can tell which of these will best fit the need of his particular farm.

The size of the cattle herd should be determined by the amount of grazing available. This is safer than trying to provide grazing for a definite number of cattle.

Once the pasture is established, the farmer should follow a well-conceived management program if he expects to continue to have a profitable grazing program over a long period of time.

Grazing and harvesting management should be started by determining the number of cattle the pasture will carry satisfactorily in a dry year. Let this be the basis for stocking. Additional cattle can well be added during the periods when abundant grazing is available. This is a much better plan than to have to sell cattle because of lack of grazing in dry weather periods. Rather than purchase additional cattle to use surplus grasses and legumes during flush periods, it is usually a better practice to take this surplus growth off as hay for winter emergency periods, or to limit the grazing to certain areas and harvest seed from others for a quick cash crop.

Fences should be so laid out as to facilitate seasonal grazing in a practical manner. Provision will need to be made for adequate water in each pasture.

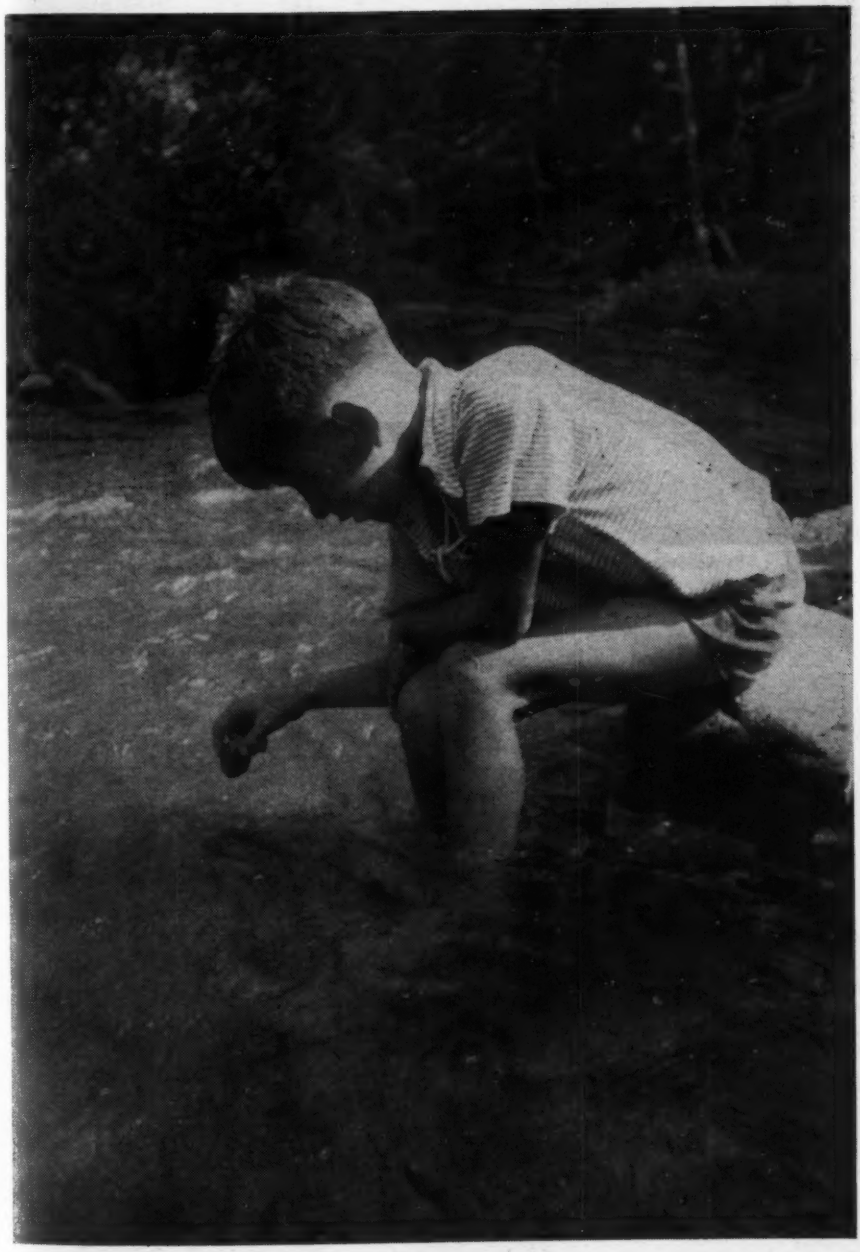
A balance between grasses and legumes in the pasture mixture is an absolute necessity for the most economical return in the form of succulent grazing.

This balance in the pasture mixture can be maintained only by applying proper minerals yearly, or in some cases every other year, and by proper management of the grazing program. Clipping should be a regular practice rather than an occasional one. This practice will keep the grasses tender and succulent and prevent unpalatable weeds from taking over. It is a common thing to find unpalatable weeds making up 75% of all green vegetation on the hill pastures of Mississippi during the late summer months. These weeds are using the plant nutrients that should be growing valuable pasture plants.

A well-conditioned soil that is a favorable medium for plant growth during extremely hot dry periods or excessively wet periods must carry a high organic content. This high organic content can be provided only by leaving some surplus plant material to go back to the soil. Considerable organic matter is added by the growth of the root system of the plants. We are told that the amount of root growth of ordinary pasture plants is comparable to the amount of top growth that is maintained. By the same reasoning, overgrazing of the top growth seriously hinders the roots in this normal function of conditioning the soil.

A deep sod of growing grasses and legumes plus a light mulch of decaying organic material on the soil surface tends to keep the soil cool, prevents erosion, and provides a means of retaining nitrogen over a longer period of time. It prevents rapid evaporation of soil moisture, creates a better condition for absorption of rainfall into the soil, and affords a better medium in which the soil organisms can carry out their normal functions.

PICTORIAL



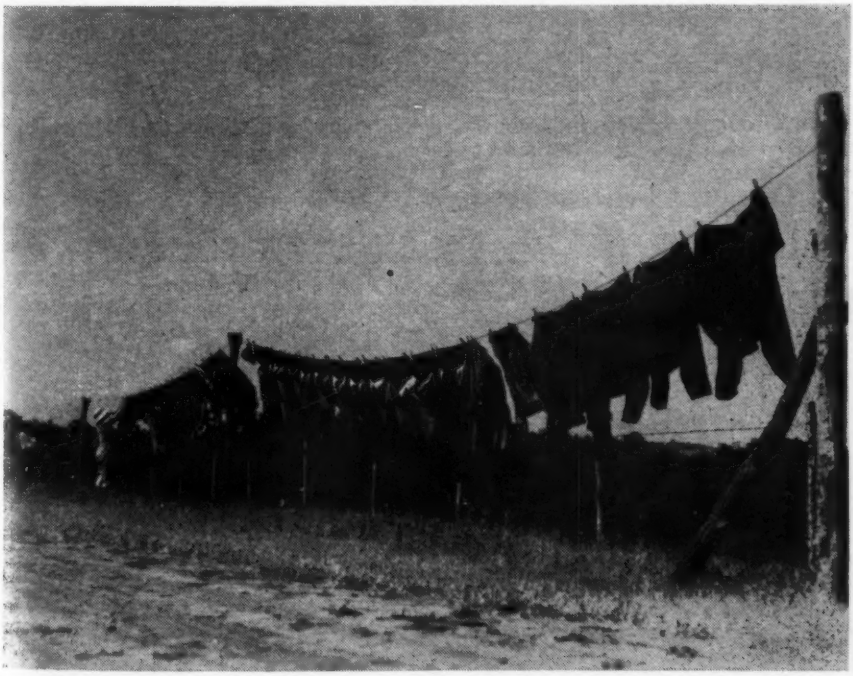
Still Too Cold for Swimming

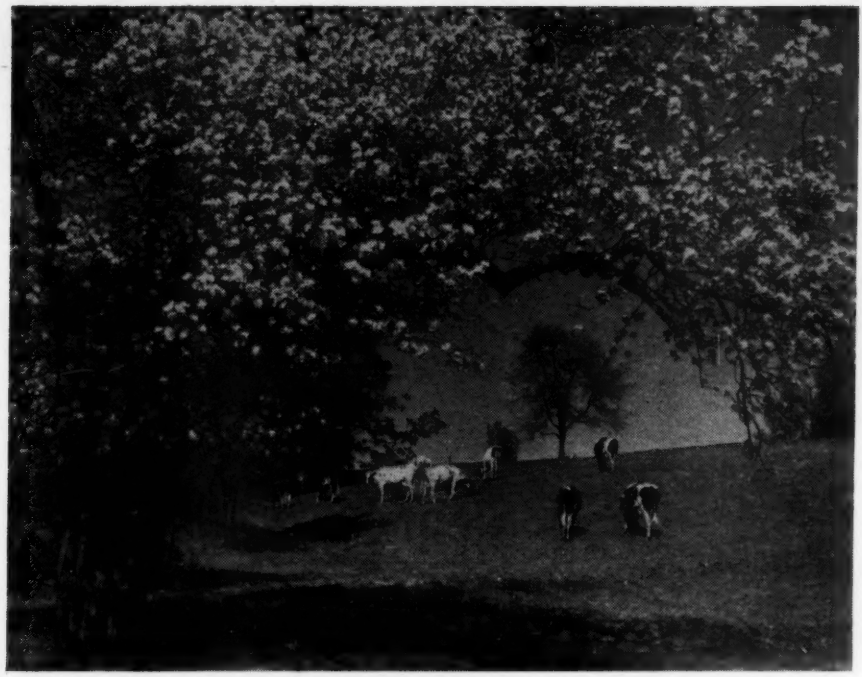
Above: A strawberry field in the Pacific Northwest.

Below: Keeping long rows of tobacco weed-free.

Above: Good gardens reward effort expended on them.

Below: Looks like several men in this family.





Above: May grazing—lush and picturesque.

Below: A beef herd on good pasture.

The Editors Talk

Our Cover Picture

The soil profile samples in the illustration on the cover of this issue were used to demonstrate both effective and improper liming of two fields of light silt loam soil on a farm in Tippecanoe County, Indiana. To complete the demonstration an alkaline black loam, No. 2 was taken from a low area on the farm. No. 3 was obtained in an oak-hickory grove close to the No. 4 field. This set of soils showed that comparative acidity tests on soil samples taken from different levels in the profile can be used to determine whether liming is necessary for the particular crop which is to be grown, or whether the lime used to date has been adequate and properly distributed throughout the topsoil. The technique is easily followed and can be used very satisfactorily in the field for demonstrating to groups of growers, and also in classrooms for vocational students.

The procedure consists of removing test samples of soil with the small measuring cup and placing them into the concavities on a porcelain test plate. Samples are taken from the 2, 4, 6, 8, 10, and 12-inch depths and arranged vertically on the spot plate. Soil Acidity Test Solution No. 1 (Brom Thymol Blue) is dropped onto each soil sample until it is thoroughly saturated, with 2 or 3 extra drops to give plenty of solution to read the color reaction at the edge of the cup. The soil is stirred with a clean stick or glass rod until no further change in color results.

The Soil Acidity Chart is then used to determine the pH or relative acidity developed in each soil sample. The color of the test solution is compared with the color graphs, and since Solution No. 1 (Brom Thymol Blue) was used, the pH values are taken from the top row of figures. When the color developed by Solution No. 1 is yellow, or brownish yellow, the test must be repeated with Solution No. 2 (Brom Cresol Green) and then the pH readings are determined by the lower figures. (See 12-inch depth sample from fields 3 and 4 marked by horizontal lines on plate.)

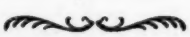
The interpretation of the test results shown on the spot plate for the four soils is as follows: Start with No. 3 which is a virgin light silt loam taken from an oak-hickory grove close by fields 1 and 4. Note that all the samples from the surface to 12-inch depth showed less than pH 5.8. A repeat test using Indicator Solution 2 (Brom Cresol Green) gave a reading of pH 4.6. This test is shown at the 12-inch level and indicates a lime need of more than four tons per acre for this type of soil.

No. 1 demonstrates an effective liming program on this field. Note the pH 6.8 reading at the 2, 4, and 6-inch levels, pH 6.6 at the 8-inch, and pH 6.2 at the 10-inch level. At 12 inches the typical acidity of pH 4.6 is found. This field was in a good state of fertility as shown by other soil tests and crop yields. No. 2 was from a low part of an adjacent field and the black loam was alkaline throughout the profile with a reading of pH 7.2.

The soil acidity tests from field No. 4 showed why an alfalfa stand failed after limestone had been applied and plowed under. The surface 2-inch sample tested pH 5.8; at 4 inches pH 6.6; at 6 inches pH 6.8. Below the plow depth a pH of less than 5.8 was soon reached. At 12 inches the Indicator No. 2 showed pH 4.6. The grower had broadcast four tons of limestone and plowed it under, instead of plowing under half this quantity and discing in the other half. The acid soil brought to the surface was unsuitable for the alfalfa seeding. The improved granulation of the soil at the 3 to 6-inch level should be noted. The acid surface soil was very sensitive to machine compactions. The tight soil from 6 to 12 inches needs the benefit of well-fertilized, deep-rooted legumes.

Summary: This demonstration procedure can be used on any soils where it is important to determine the acidity conditions at different levels. It always interests growers to see how effective their particular liming programs have been. Many are surprised to learn how ineffective their applications were in correcting the acid soil conditions detrimental to some of the crops they wish to grow. The soil profile samples often demonstrate soil compactions below the plow depths.

(The soil samplers are sold by the Oliver Corporation, South Bend, Indiana, and the Elano Corporation, Xenia, Ohio. The porcelain spot plates can be purchased from Wilkens Anderson Company, Chicago, Illinois, or any other chemical supply company. The soil acidity indicator solutions and charts are supplied by the Department of Agronomy, Purdue University, Lafayette, Indiana.)



More Fertilizer

Now that supplies of fertilizers appear to be adequate to meet the demand, there will be greater interest than ever in the economics of using more fertilizer. The following comments appearing in the May 1953 issue of the magazine "Agricultural Chemicals" indicate that work by the U. S. Department of Agriculture confirms statements made by the fertilizer industry that more plant food can be used with profit to the farmer.

"In keeping with assertions made by the trade that increased use of fertilizer materials is the best answer to the farmer's battle against shrinking income, the U. S. Department of Agriculture has recommended to growers that they step up, rather than reduce, their fertilization programs.

"Pointing out that supplies of fertilizer materials are expected to be ample in 1953, the U. S. D. A. declares that 'In relationship to prospective prices of farm products, it will still pay many farmers to use more fertilizer.' Even though prices on the material may rise slightly, this still holds true, the agency continues.

"Using the corn crop as an example, the Department points out that in the eastern section of the corn belt, the most profitable rate of fertilizer application per acre averages about 175 pounds of plant nutrients, or 875 pounds of a product carrying 20% plant nutrients. 'This is probably ten times the rate applied on the average acre of corn in this area,' it is observed.

"The economics of fertilizer use, as emphasized by the National Fertilizer Association and other groups, is more than confirmed by the U. S. D. A. It points out that the farmer, short of labor, will find that at the most profitable rate of application, the yield of corn per man hour of labor is about three times as large as where no fertilizer is applied.

"When fixed costs are high, it is important to give particular attention to practices that increase yields, the Department concludes."

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.2	163.0	306.0	168.0	211.0	19.50	69.30	....
1952									
May.....	36.08	43.5	264.0	433.0	170.0	213.0	18.65	60.80	....
June.....	38.02	44.0	310.0	436.0	173.0	206.0	17.05	61.90	....
July.....	37.02	42.0	274.0	446.0	173.0	198.0	17.25	71.00	....
August.....	37.92	48.8	278.0	410.0	173.0	204.0	19.35	69.80	....
September...	39.11	51.0	222.0	335.0	171.0	209.0	20.25	69.60	....
October.....	36.77	50.9	211.0	294.0	153.0	207.0	20.85	70.70	....
November...	34.05	47.6	217.0	311.0	145.0	213.0	21.25	69.70	....
December....	31.71	49.6	199.0	362.0	150.0	212.0	21.65	68.50	....
1953									
January.....	29.79	46.2	206.0	386.0	148.0	210.0	21.65	65.30	....
February....	30.19	36.7	179.0	384.0	143.0	205.0	20.85	64.50	....
March.....	31.52	....	165.0	401.0	146.0	210.0	19.65	63.60	....
April.....	31.45	....	134.0	409.0	146.0	208.0	18.85	63.10	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948.....	245	482	222	253	201	226	155	298	214
1949.....	231	459	184	244	193	213	139	192	201
1950.....	323	517	132	197	238	226	141	384	185
1951.....	306	512	233	349	262	239	164	307	239
1952									
May.....	291	435	379	493	265	240	157	270	285
June.....	307	440	445	497	269	233	144	275	250
July.....	299	420	393	508	269	224	145	315	287
August.....	306	488	399	467	269	231	163	310	229
September...	315	510	319	382	266	236	171	309	182
October.....	297	509	303	335	238	234	176	314	189
November...	275	476	311	354	226	241	179	309	238
December....	256	496	286	412	234	240	182	304	256
1953									
January.....	240	462	296	440	231	238	182	290	237
February....	243	367	257	437	223	232	176	286	237
March.....	254	...	237	457	227	238	166	282	248
April.....	254	...	192	466	227	235	159	280	204

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.38
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952						
May	3.34	2.07	14.25	11.28	7.75	7.36
June	3.34	2.07	14.27	11.28	8.38	8.38
July	3.34	2.07	14.26	11.28	8.19	7.59
August	3.34	2.07	14.26	11.28	9.78	7.89
September	3.34	2.07	13.39	11.25	11.11	10.02
October	3.34	2.07	13.39	11.24	10.62	9.41
November	3.34	2.07	13.31	11.24	10.32	9.71
December	3.34	2.26	13.20	11.24	9.95	9.17
1953						
January	3.34	2.28	13.25	11.24	8.43	8.05
February	3.34	2.28	13.21	11.24	7.75	7.28
March	3.34	2.28	12.69	11.24	7.16	6.56
April	3.34	2.28	11.75	11.24	6.07	6.00
Index Numbers (1910-14 = 100)						
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952						
May	125	73	407	320	230	209
June	125	73	408	320	249	238
July	125	73	407	320	243	216
August	125	73	407	320	290	224
September	125	73	383	319	330	285
October	125	73	383	318	315	267
November	125	73	380	318	306	276
December	125	79	377	318	295	261
1953						
January	125	80	379	318	250	229
February	125	80	378	318	230	207
March	125	80	363	318	212	186
April	125	80	336	318	180	170

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952							
May	.860	3.98	5.47	.420	.827	16.00	.210
June	.860	3.98	5.47	.353	.708	13.44	.176
July	.860	3.98	5.47	.386	.768	14.72	.193
August	.860	3.98	5.47	.386	.768	14.72	.193
September	.860	3.98	5.47	.389	.768	14.72	.193
October	.860	3.98	5.47	.391	.768	14.72	.193
November	.860	3.98	5.47	.391	.768	14.72	.193
December	.860	3.98	5.47	.427	.827	16.00	.210
1953							
January	.860	3.98	5.47	.430	.827	16.00	.210
February	.860	3.98	5.47	.430	.827	16.00	.210
March	.860	4.22	5.47	.430	.827	16.00	.210
April	.860	4.28	....	.430	.827	16.00	.210
			Index Numbers (1910-14 = 100)				
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952							
May	160	110	112	75	87	66	85
June	160	110	112	65	74	56	80
July	160	110	112	70	81	61	82
August	160	110	112	70	81	61	82
September	160	110	112	70	81	61	82
October	160	110	112	70	81	61	82
November	160	110	112	70	81	61	82
December	160	110	112	75	87	66	85
1953							
January	160	110	112	76	87	66	85
February	160	110	112	76	87	66	85
March	160	117	112	76	87	66	85
April	160	119	...	76	87	66	85

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and all Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1927.....	141	148	139	116	89	150	100	94
1928.....	149	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	123	130	127	86	56	130	102	77
1942.....	158	149	144	93	57	161	112	77
1943.....	192	165	151	94	57	160	117	77
1944.....	196	174	152	96	57	174	120	76
1945.....	206	180	154	97	57	175	121	76
1946.....	234	197	177	107	62	240	125	75
1947.....	275	231	222	130	74	362	139	72
1948.....	285	250	241	134	89	314	143	70
1949.....	249	240	226	137	99	319	144	70
1950.....	256	246	236	132	89	314	142	72
1951.....	302	271	263	139	93	331	152	76
1952								
May.....	293	276	252	142	98	306	160	78
June.....	292	273	250	141	98	316	160	69
July.....	295	273	250	141	98	313	160	73
August....	295	274	252	144	98	337	160	73
September.	288	271	250	145	98	349	160	74
October...	282	269	248	145	98	341	160	74
November.	277	268	248	144	98	336	160	74
December..	269	267	246	146	101	329	160	79
1953								
January...	267	267	246	144	102	307	160	80
February..	263	264	246	142	102	296	160	80
March....	264	265	248	141	102	282	160	80
April.....	259	264	246	139	102	256	160	80

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fifteenth Annual Report of the Arizona Fertilizer Control Office Fertilizers and Agricultural Minerals—Year Ending December 31, 1952," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Sp. Bul., March 1953.

"Commercial Fertilizers Report for 1952," Conn. Agr. Exp. Sta., New Haven, Conn., Bul. 563, Dec. 1952, H. J. Fisher.

"Fertilize Corn for 100 Bushels," Agr. Ext. Serv., Univ. of Del., Newark, Del., Ext. Fldr. 27, Feb. 1952, Rev. Jan. 1953.

"Inspection of Commercial Fertilizers and Agricultural Lime Products by Fertilizer Control Service Staff," Mass. Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. 154, Aug. 1952.

"Better Stand Plus Proper Fertilization Equals More Corn per Acre," Agr. Ext. Serv., Univ. Farm, St. Paul, Minn., Ext. Fldr. 166, April 1952, A. C. Caldwell.

"Feed Your Corn For X-Tra Yields," Agr. Exp. Sta., Univ. Farm, St. Paul, Minn., Misc. Paper 811, P. M. Burson, C. O. Rost, and H. E. Jones.

"Fertilizers and Limes—1952," Agr. Exp. Sta., Univ. of N. J., New Brunswick, N. J., Insp. Ser. 49, Jan. 1953, S. B. Randle.

"Effect of Fertilizers on the Yield and Chemical Composition of Pasture Forage at Nacogdoches, 1949-51," Agr. Exp. Sta., Tex. A&M College, College Sta., Tex., Prog. Rpt. 1493, Aug. 30, 1952, H. C. Hutson, F. L. Fisher, and L. C. Kapp.

"Distribution of Fertilizer Sales in Texas, January 1-June 30, 1952," Agr. Exp. Sta., Tex. A&M College, College Sta., Tex., Prog. Rpt. 1498, Sept. 26, 1952, J. F. Fudge.

"County Fertilizer Data for Texas, January 1 through June 30, 1952," Agr. Exp. Sta., Tex. A&M College, College Sta., Tex.

"Effect of Fertilizer and Moisture on the Growth and Yield of Sweet Corn," Agr. Exp. Sta., Utah Sta. College, Logan, Utah, Bul. 360, Feb. 1953, J. B. Peterson and J. C. Ballard.

"Selecting and Using Fertilizers," Agr. Exp. Sta., Utah Sta. College, Logan, Utah, Cir. 132, Feb. 1953, H. B. Peterson, R. F. Nielson, and J. P. Thorne.

"Fertilizer Pays," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Brieflet 898, March 1953, R. H. Tremblay.

Soils

"Sprinkler Irrigation of Tree Fruits and Vegetables in British Columbia," Exp. Farms Serv., Dept. of Agr., Ottawa, Canada, Pub. 878, Jan. 1953, J. C. Wilcox.

"Irrigation Farming in Southern Alberta," Exp. Sta., Lethbridge, Alberta, Pub. 883, March 1953, K. W. Hill and A. E. Palmer.

"The Value of Soil Testing Kits in Vegetable Crop Production," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-48, April 1952, E. L. Spencer and J. R. Beckenbach.

"Soils of Georgia Their Formation, Classification and Management," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Bul. 2, Jan. 1953, R. L. Carter and J. Giddens.

"Sensitivity of Potatoes to Soil Porosity," Agr. Exp. Sta., Wooster, Ohio, Res. Bul. 726, March 1953, J. Bushnell.

"Have Your Soil Tested—Know What It Needs," Ext. Div., Okla. A&M College, Stillwater, Okla., Cir. 579.

"Soils of Virginia," Ext. Serv., Va. Poly. Inst., Blacksburg, Va., Bul. 203, March 1953.

Crops

"Birdsfoot Trefoil in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 421, M. L. Peterson, L. G. Jones, and V. P. Osterli.

"The Grape in Ontario," Hort. Exp. Sta., Vineland Sta., Ontario, Bul. 487, June 1952, O. A. Bradt.

"Nut Culture in Ontario," Hort. Exp. Sta., Vineland Sta., Ontario, Bul. 494, Sept. 1952, W. J. Strong.

"Small Grains for Fall Pasture," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., Bul. 294, Nov. 1952, B. A. Brown and R. I. Munsell.

"Growing Tobacco in Connecticut," Agr. Exp. Sta., New Haven, Conn., Bul. 564, Jan. 1953, P. J. Anderson.

"Growing Alfalfa in Connecticut," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 445, March 1953, R. I. Munsell.

"Summer Squash," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Fldr. 55, Feb. 1952, E. C. Minnum.

"Results of Growing Corn Continuously on the Same Soil—A Progress Report," Agr. Exp. Sta., Univ. of Conn., Storrs, Conn., Inf. 39, March 1952, R. I. Munsell.

"Grow Your Own Vegetables," Dept. of Agr., Tallahassee, Fla., Bul. 52, July 1952.

"Compatability of Insecticides, Fungicides and Nutrients for Vegetable Crops," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-47, April 1952, E. G. Kelsheimer, J. M. Walter, and J. R. Beckenbach.

"Big Trefoil—A New Pasture Legume for Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-49, Aug. 1952, A. T. Wallace and G. B. Killinger.

"Pastures for Georgia," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Bul. 573, March 1952, E. D. Alexander.

"Experimental Corn Hybrids 1952 Tests," Agr. Exp. Sta., Univ. of Illinois, Urbana, Ill., Bul. 563, Jan. 1953, L. F. Bauman, D. E. Alexander, R. W. Jugenheimer, and C. M. Woodworth.

"1952 Illinois Corn Tests—Variety Performance, Seed Treatment, and Rate of Planting," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Bul 564, Jan. 1953, J. W. Pendleton, G. H. Duncan, B. Koehler, J. H. Bigger, A. L. Lang, and P. E. Johnson.

"5 Steps in Pasture Improvement," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 703, Nov. 1952, E.D. Walker and J.C. Hackleman.

"Spring Oat Varieties for Illinois," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., Cir. 704, Feb. 1953, J. W. Pendleton, W. M. Bever, O. T. Bonnett, and G. E. McKibben.

"A Preliminary Annual Report on Experiments Conducted by the Crops and Soils Department of the Louisiana Agricultural Experiment Station—1952," Agr. Exp. Sta., La. Univ., Baton Rouge, La.

"A Preliminary Annual Report on Experiments Conducted by the Crops and Soils Department of the Louisiana Agricultural Experiment Station, 1951," Agr. Exp. Sta., La. Univ., Baton Rouge, La.

"Twentieth Annual Report of the Secretary of the State Board of Agriculture of the State of Michigan and Sixty-Fifth Annual Report of the Agricultural Experiment Station, July 1, 1951 to June 30, 1952," State Board of Agr., Lansing, Mich.

"Planting the Farmstead Shelter Belt," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Bul. 196, Reprinted March 1953, P. Anderson.

"Corn Hybrids and Varieties—1952 Tests in Mississippi," Agr. Exp. Sta., Miss. Sta. College, State College, Miss., Bul. 498, Jan. 1953.

"Sweetpotato Variety Trials and Seed Production Practices," Agr. Exp. Sta., Miss. Sta. College, Sta. College, Miss., Cir. 178, Feb. 1953, W. S. Anderson and J. A. Campbell.

"Garden Vegetables," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., E. C. 1274, 1952, W. Whitney, W. Ringler, R. Helm, and J. Weihing.

"Questions and Answers on Grass and Legume Silage," Agr. Ext. Serv., Univ. of Nebr., Lincoln, Nebr., C. C. 113, May 1952.

"Field Crops Recommendations 1953," Agr. Ext. Serv., Univ. of N. J., New Brunswick, N. J., Leaf. 99, Dec. 1952, J. E. Baylor and R. A. Briggs.

"Bromegrass in New Jersey," Agr. Exp. Sta., Univ. of N. J., New Brunswick, N. J., Bul. 766, Jan. 1953, G. H. Ahlgren, H. D. Gross, and M. A. Sprague.

"New Blueberry Varieties for New Jersey," Agr. Exp. Sta., Univ. of N. J., New Brunswick, N. J., Bul. 767, Dec. 1952, G. M. Darrow, D. H. Scott, and G. J. Galletta.

"Peach Growing," Agr. Exp. Sta., Cornell Univ., Ithaca, N. Y., Bul. 869, Jan. 1953, L. J. Edgerton.

"Growing Camellias as a Hobby," Agr. Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 377, Sept. 1952, J. M. Napier.

"Fiber Characteristics and Spinning Performance of Mechanically-stripped Cotton on the High Plains," Agr. Exp. Sta., Tex. A&M College, College Sta., Tex., Bul. 757, Feb. 1953, J. M. Ward, L. E. Hessler, and W. E. Paulson.

"Growing Grain Sorgums," Agr. Ext. Serv., Tex. A&M College, College Sta., Tex., B-210, E. A. Miller, L. C. Coffey, and W. B. Coke.

"Berseem Clover for Forage and Seed Production," Agr. Exp. Sta., Tex. A&M College, College Sta., Tex., Prog. Rept. 1494, Sept. 8, 1952, M. E. Riewe and J. C. Smith.

"Green Manure Crops At Kirbyville and Cleveland, 1951-52," Agr. Exp. Sta., Tex. A&M College, College Sta., Tex., Prog. Rpt. 1496, Sept. 25, 1952, J. R. Wood, C. A. Burleson, and E. D. Cook.

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"Recommended Vegetable Varieties for Utah," Agr. Ext. Serv., Utah State College, Logan, Utah, No. 12, June 1952, E. M. Anderson.

"Growing Spring Wheat in Utah," Agr. Ext. Serv., Utah State College, Logan, Utah, No. 4, G. T. Baird and G. H. Bingham.

"Aromatic Tobacco Production," Agr. Ext. Serv., Va. Poly. Inst., Blacksburg, Va., Bul. 204, March 1953.

"Large Yields, Better Quality Tobacco," Agronomy Dept., Va. Poly. Inst., Blacksburg, Va., Cir. 386, Rev. Jan. 1953.

"Science Serves Your Farm," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 357, Part 1, Sept. 1952.

"Results of Hybrid Corn Yield Trials in West Virginia, 1952," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Cur. Rpt. 4,

March 1953, W. L. Haltiwanger, C. W. Neal, and R. J. Friant.

"Chemical Composition of Wyoming Forage Plants," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. 311, Feb. 1952, O. A. Beath and J. W. Hamilton.

"Classification of Flax Varieties 1946," USDA, Wash., D. C., Tech. Bul. 1064, Feb. 1953, A. C. Dillman.

"Tree and Shrub Species for the Northern Great Plains," USDA, Wash., D. C., Cir. 912, Jan. 1953, E. J. George.

"Field Crops Hits for '53," Agr. Ext. Serv., N. Y. Sta. College, New York, N. Y.

Economics

"Snap Beans: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 43, April 1952, C. C. Taylor and J. C. Elrod.

"Sericea Lespedeza: Production Practices and Costs in the Piedmont of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 44, April 1952, W. T. Fullilove and J. C. Elrod.

"Tomatoes: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 45, May 1952, C. C. Taylor.

"Lima Beans: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 46, May 1952, J. V. Minchew and J. C. Elrod.

"Cantaloupes: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 47, May 1952, C. C. Taylor and W. T. Fullilove.

"Irish Potatoes: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 48, May 1952, J. V. Minchew.

"Sweet Corn: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 49, May 1952, J. V. Minchew.

"Watermelons: Production Practices and Costs in the Coastal Plain of Georgia," Ga. Exp. Sta., Experiment, Ga., Mim. Ser. 50, May 1952, J. V. Minchew and W. T. Fullilove.

"An Economic Appraisal of Beef Cattle Production in Northeast and East Central Mississippi," Agr. Exp. Sta., Miss. Sta. College, Sta. College, Miss., Bul. 497, Feb. 1953, T. E. Tramel and D. W. Parvin.

"Looking Ahead with Montana Farmers and Ranchers," Agr. Ext. Serv., Mont. State College, Bozeman, Mont., Fldr. 22, Sept. 1, 1952, H. R. Stucky.

"An Economic Study of Improved Pastures," Agr. Exp. Sta., Oreg. Sta. College, Corvallis, Oreg., Exp. Sta. Bul. 520, Aug. 1952, E. A. Hyer and M. H. Becker.

"An Economic Analysis of the Agricultural Potentials of the Weber Basin Reclamation Project Utah," Agr. Exp. Sta., Utah Sta. Agr. College, Logan, Utah, Sp. Rpt. 7, Dec. 1952, W. U. Fuhriman, G. T. Blanch, and C. E. Stewart.

"Adjustment of Veteran Trainees to Farming and Rural Life," Agr. Exp. Sta., Sta. College of Wash., Pullman, Wash., Bul. 541, April 1953, W. L. Slocum.

"Agricultural Statistics 1952," USDA, Wash., D. C.

It Pays to Fertilize According to Soil Test

SOIL tests have paved the way to higher yields and greater profits. Corn yields were stepped up an average of 28 bushels per acre in 1952 on 21 northwest Missouri farms where full soil treatments were made and compared to adjacent areas in the same fields receiving conventional applications. Where fertilizers were applied according to soil tests, yields averaged 107 bushels per acre. On adjacent areas receiving the usual application of fertilizer in the row at planting time, average yield was 79 bushels per acre.

A. W. Klemme, University of Missouri, Soils Specialist, in explaining the importance of fertilizing according to test, says that the level of such plant nutrients as phosphate and potash in an available form in the soil must be several times greater than the amount used by the growing plant. This is because phosphate and potash move through the soil only to a small extent. And the corn plant roots can contact only a small part of the soil.

Full soil treatments eliminate these elements as limiting factors to plant

growth. In addition to increasing yields by 28 bushels per acre on these northwest Missouri farms, these heavier fertilizer applications increased the phosphate and potash reserves of the soil. On an average, about 80 pounds more phosphate and 56 pounds more potash were added than removed by the crops. Nitrogen application was about equal to that removed in the grain. At present fertilizer prices, this added reserve of phosphate and potash has a value of approximately $9 per acre.

On the other hand, where starter fertilizers were used in the conventional amounts, the crops removed about the same amount of phosphate and potash as was supplied in the fertilizer. But the nitrogen reserve was reduced by some 65 pounds per acre. At present fertilizer prices, it would cost at least $6.50 per acre to replace this loss through use of commercial nitrogen.

The wide variation in fertilizer needs on the 21 northwest Missouri farms again shows the importance of proper soil testing. The applications required per acre to remove these major plant nutrients as limiting factors ranged from 20 to 162 pounds of nitrogen, 16 to 340 pounds of phosphate, and 6 to 192 pounds of potash. Where the heavy applications were required, the mineral fertilizers were applied on the surface and plowed under. The same method was used for solid nitrogen materials such as ammonium nitrate. Anhydrous ammonia was applied with a special applicator before plowing, during seed-bed preparation, or at the first cultivation.

Soil tests can be obtained at any of the 85 county soil testing laboratories under the supervision of county agents. Or this service may be secured by sending samples to the Department of Soils of the University of Missouri.

Pure Plant Foods

WHEN you buy a hundred-pound bag of fertilizer you may get only 30 pounds of plant food.

But don't be alarmed. That extra 70 pounds of carrier material are vital to success of your fertilizer operation.

Art Peterson, Soil Specialist at the University of Wisconsin, explains it this way. He says you throw away coffee grounds every time you brew up a pot. You have to have the grounds before you get the coffee flavor. The same is true in fertilizer. You need this extra carrier material to carry along the real plant food.

Why can't we spread pure fertilizer? Peterson says pure nitrogen would be a gas as in air. Phosphate would be in the form of a yellow wax and would burst into flame in ordinary air. Pure potash looks like lead and is kept under oil to keep it from burning.

He does say that fertilizer makers are constantly working to include more of the pure stuff in their product. These high analysis fertilizers are the best deal for the farmer, all things considered.

For example, 60 pounds of 5-20-20 contain as much nitrogen, phosphorus, and potash as 100 pounds of 3-12-12. With the higher concentrate a farmer has less weight to handle. And the danger of "burning" a crop is less because less total salts are put on the ground. Finally, with the richer fertilizer, you'll probably pay less for every pound of plant nutrients.

He says, it definitely pays to read the fertilizer label before you buy. Here's the way an analysis reads—in a 5-20-20 fertilizer, the 5 stands for nitrogen, the first 20 for phosphorus, and the last 20 for potash.

Fertilizers Move West . . .

(*From page* 23)

treatments. The chief advantage of spring application lies in the fact that one can rather accurately estimate the need for a nitrogen supplement according to the deficiency symptoms and moisture supply after the crop has commenced growth in spring. Moreover, higher protein wheat generally results with the spring treatment. On the other hand, fertilizer may be more readily available on the market in fall, and more time for field application may then be available."

Fall applications of nitrogen should not be placed with the seed, as the germination may be reduced if the soil remains dry for an extended period.

During the same six years, in 18 southeastern Nebraska experiments, the spring topdressing with 40 pounds nitrogen alone gave an average grain-yield increase of six bushels per acre. A fall application of 30 pounds P_2O_5 additional to the 40 pounds nitrogen in spring raised the gain to 11 bushels. It would not be good fertilizer practice to apply phosphorus alone on land that is deficient in both nitrogen and phosphorus. Under such circumstances both elements should be supplied. Likewise, phosphorus fertilizer applied alone to soils that are clearly deficient in nitrogen but not in phosphorus tends to depress yields. In any

TABLE I.—EFFECT OF FERTILIZING THE CORN AND SMALL GRAIN PLOTS IN VARIOUS ROTATIONS WITH 40 POUNDS OF NITROGEN IN THE FORM OF AMMONIUM NITRATE. AGRONOMY FARM, LINCOLN, NEBRASKA, 1951.[1]

Rotation		Nitrogen added per acre	Yield per acre (14% moisture)							
			Corn following:					Wheat	Oats	Barley
No.	Crop sequence[2]		Wheat	Oats	Corn	Sweetclover	Av.			
		Lbs.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Unmanured rotations										
2	W–C–O–C–C–B....	0	35.7	40.8	28.8	.....	35.1	18.8	30.9	6.9
		40	64.8	66.2	43.7	.....	58.2	25.8	56.2	.....
4	W–C–Osc–Sc–C–B..	0	51.7	.....	.....	69.6	60.7	24.8	32.8	11.0
		40	76.4	.....	.....	78.8	77.6	31.4	51.8	.....
Manured rotations										
8	Wm–C–O–C–C–B..	0	53.9	60.3	39.3	.....	51.2	30.8	51.6	14.9
		40	71.7	69.0	54.9	.....	65.2	31.6	68.9	.....
9	Wm–C–Osc–Sc–C–B	0	70.0	.....	.....	79.4	74.7	30.2	49.1	17.6
		40	82.6	.....	.....	85.0	83.8	28.1	62.2	.....

[1] The nitrogen was applied in the spring of 1951 to one-half of each plot.
[2] W = winter wheat, C = corn, O = oats, B = barley, Rc = red clover, Sc = sweetclover, M = 12 tons manure per acre.

case, 30 pounds P_2O_5 have proved to be an adequate amount.

Topdressing of oats in spring in various sections of eastern Nebraska during four years with 40 pounds of nitrogen gave an average annual increase of 14.5 bushels per acre. Such an increase at $0.85 per bushel has a market value of $12.32. This is double the cost of the fertilizer at $0.15 per pound nitrogen content. The same carriers of nitrogen are suitable for oats as for wheat.

Phosphorus alone has failed to increase the yield. In occasional tests, its application at the rate of 30 pounds P_2O_5 per acre at time of planting has increased the yield where the crop was topdressed later with nitrogen. There are evidently some P_2O_5 deficient localities. Further experiments and experience of farmers will doubtless establish their locations.

Where oats is used as a companion crop for starting legumes, phosphorus is recommended primarily for the benefit of the legume. Nitrogenous fertilizer will help not only the small grain but will aid in the stand establishment of the legume as well.

Fig. 2. Effect of topdressing small grain in spring with 40 pounds nitrogen in a 6-year straight grain rotation on the Nebraska Agricultural Experiment Station farm, 1951. Above: Winter wheat; left—no fertilizer, yield 18.8 bushels per acre; right—with fertilizer, yield 25.8 bushels per acre. Below: Oats; left—no fertilizer, yield 30.9 bushels per acre; right—with fertilizer, yield 56.2 bushels per acre.

It is considered in the western Corn Belt, where soil moisture deficiency is commonly a limiting factor of production, that a combination of crop rotations including forage legumes and grasses and the application of manure and commercial fertilizers as needed is the most desirable and profitable way of growing crops.

For example, in the Experiment Station long-time crop rotation experiments at Lincoln in 1951, the effect of a spring application of 40 pounds of nitrogen, in the form of ammonium nitrate, was determined for comparable manured and non-manured legume and non-legume rotations of 6-year duration. The results can be visualized best by reference to Table I.

In a 6-year straight-grain rotation, the average yield of the three corn crops was increased 23.1 bushels per acre by the application of 40 pounds of nitrogen to each crop, compared with an increase of 16.1 bushels due to an application of 12 tons of manure on wheat in one year out of six. Forty pounds of nitrogen additional to the manure in this rotation increased the corn yield 30.1 bushels per acre. Corresponding yield increases in winter wheat were 7, 12, and 12.8 bushels. For oats they were 25.3, 20.7, and 38 bushels.

In a 6-year sweetclover rotation in which the clover was grown two years and harvested for hay in the second year, the average yield of the two corn crops was increased 25.6 bushels per acre by the sweetclover alone, and 39.6 bushels by the combination of sweetclover and manure. Forty pounds of nitrogen together with the non-manured sweetclover added 42.5 bushels per acre (Fig. 1), whereas the combination of sweetclover, manure, and nitrogen in the rotation added 48.7 bushels. Corresponding yield increases in wheat (Fig. 2) were 6.0, 11.4, 12.6, and 9.3 bushels. The addition of nitrogenous fertilizer to a manured sweetclover rotation proved excessive for wheat to which the manure also was applied. For oats (Fig. 2) the respective increases were 1.9, 18.2, 20.9, and 31.3 bushels. It is quite a jump from 31 to 62 bushels of oats. No study was made of the effects of nitrogen on barley in this rotation.

With such crop responses as herein presented in a state that has only recently become fertilizer conscious, it is possible to understand the 4,211% increase in the fertilizer consumption in Nebraska in 1951 as compared with 1941, as reported by The National Fertilizer Association.

Trefoil Is Different . . .

(*From page* 16)

the whole remixed. After setting a while most of the stickiness disappears and the rest can be taken care of by adding some pulverized superphosphate, lime, corn starch, corn meal, or chicken feed.

Early Planting.

Trefoil is a slow starter. Therefore, the earlier it is planted in the spring, the longer growing season it will have. The longer the growing season, the better the chances of developing a large root system so that it can withstand the first-year hazard of winter heaving. This problem of heaving is especially severe on the heavier clay soils to which trefoil is so well adapted.

In many cases, planting trefoil on frozen ground in the spring has been very successful. In this case the land should be fall-fitted and the grass planted at that time or it can be seeded on frozen ground at the same time as the trefoil.

Conventional spring plantings are probably more certain than "frost plantings." A well-prepared seedbed is essential and it should be cultipacked before seeding, to provide a firm seedbed. Seed should not be planted deeper than ¼ inch. After seeding the land should be cultipacked once more.

Minimum Competition.

Next to inadequate inoculation, overcrowding of trefoil has been responsible for more seeding failures than any other single factor. There are several steps that can be taken to overcome this:

1. Don't seed alfalfa, ladino, or red clover with trefoil. They are more rapid growers and so crowd it badly.
2. If you must use oats as a companion crop with trefoil, cut the planting rate down as low as possible and never over one bushel per acre.
3. Never let the oats go for grain but instead graze them off just as early as possible. They should be grazed when they are from 6 to 8 inches high. Regraze if they come back or graze and clip as often as necessary to control weeds.
4. A much more satisfactory method of reducing competition is to plant no companion (nurse) crop at all. This means a little extra work in controlling weeds but is well worth the labor. Frequent clipping to control weeds opens up the stand and gives trefoil a chance to send out extra shoots from the crown, each with its many leaves. Otherwise it must depend upon one shoot with a few leaves trying to work its way up through a jungle of rapidly growing oats or weeds. Trefoil manufactures its food in its leaves as do all plants. Therefore, frequent clipping the first year really acts as a fertilizer in that it permits trefoil to produce many more branches and leaves, thus greatly increasing its food-manufacturing ability. Rather close and frequent clipping usually sets the weeds back and does more damage to them than to the young trefoil.

More Cotton on Less Land . . .

(*From page* 12)

of Mississippi can average per acre. The first secret to the high yields produced by the five-acre contestants was that land was selected that had a capacity to use large quantities of fertilizers and were well adapted for the production of high yields of cotton. Then the insects and other pests were controlled completely. The local weather conditions during the growing season were, of course, important. The five-acre contest is on again in 1953 and we shall wait patiently to find out what the yields will be this fall.

The average yield of cotton by all the farmers in Mississippi as well as in other states should and will be increased in the future. The Extension Service in Mississippi has a goal of trying to get the farmers to produce a bale of cotton on every acre planted. Several farmers established this rule several years ago and have been living up to it. This is not an unreasonable goal and can be accomplished if the farmers will practice good land selection, control the harmful insects, and apply nitrogen, phosphorus, potash, and lime as needed by the soils. By using the research information available, farmers can produce a bale or more on every acre planted, which will mean that approximately as much cotton as is now being harvested can be produced on much less acreage.

It is recognized that this would not help the cotton market situation, but

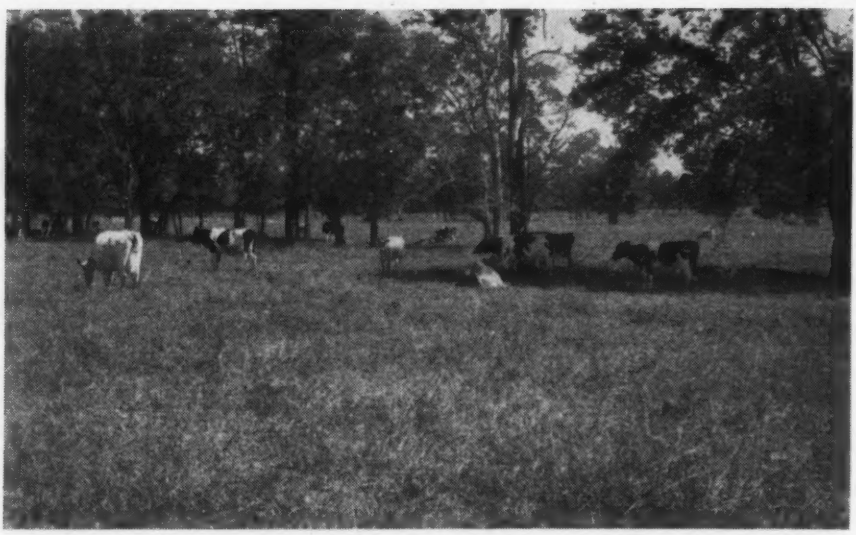

Fig. 7. Land that is too wet for profitable cotton production is well suited for the production of pastures and livestock products. (Courtesy Dr. O. T. Osgood.)

more land would be made available for other uses. These acres could be used for the production of pastures and livestock, forage and seed crops which are needed over the Southland. This is not doing away with cotton but merely putting cotton and the other important crops in their respective places, and recognizing the ability of soil conditions to produce and to use fertilizers. These are fundamentals of wise land use which have helped people to realize the opportunities available in agriculture in the South.

Grassland Farming . . .

(*From page* 20)

cases perennials growing with annuals part of the year. Research is available so farmers can manage every grass and clover or any combination right if they will make a plan to use the research. Southern pasture management is done on a seasonal basis because certain grasses and clovers grow better during one season than they do during another. Spring pastures are usually better than those of any other season of the year and there is more grazing available then than at any other time. Many times the management given the spring pasture determines what kind of summer and fall pastures will be on that land.

Fescue and Clovers

Fescue and white clover are a combination widely used in the South for spring grazing and must have specific management to keep a 50-50 mixture of grass and clover. Even though clovers gather nitrogen and just about furnish enough nitrogen for the grasses that grow with them, it will pay on most pastures to topdress fescue with 30 or 40 pounds of nitrogen March 1 so that it can compete with the fast-growing clover. Both white

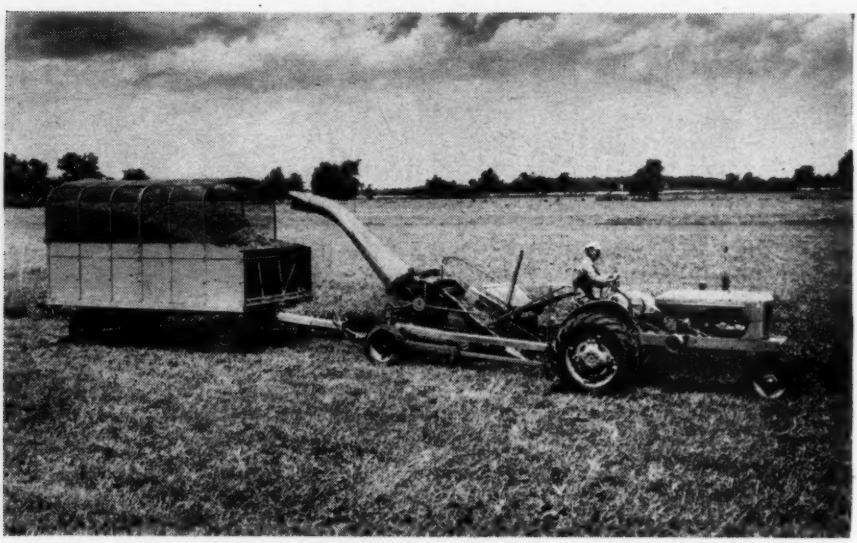

Fig. 5. This modern field chopper is harvesting a crop for grass silage.

clover and fescue are perennials and if one gets the upper hand, the mixture is unbalanced.

Heavy grazing should be practiced on the fast-growing clovers during the spring months so the fescue won't be choked out. About the only way to keep fescue in the clover during the fast clover-growing period is with extra nitrogen. In most sections, grazing should be limited in June and the fescue given a complete rest during July, August, and September unless a lot of extra rain comes and causes growth that can be grazed off without staying on the fescue long periods of time.

Sixty pounds of nitrogen should be applied on the fescue for fall growth in October and it will be better to wait until the Bermuda and Dallis growth are about over before the nitrogen is applied. Otherwise, they will come out quickly and tend to choke out the fescue.

In the fall it is good practice to apply the annual needs in minerals as a topdressing to fescue and ladino. This can be done by applying 600 to 800 pounds of 0-14-14, or 800 pounds of a mixture such as 6-8-8 or 8-8-8, or any mixture that is well balanced with phosphorus and potash. If mixed fertilizer is used, add enough nitrogen to make the total nitrogen application 60 pounds. Many states apply 1,000 pounds of 3-12-12 each year as topdressing and extra nitrogen.

Fescue will use about 1 pound of nitrogen per day per acre during the fall growing season. In November or December, if the weather is good and grazing is needed, it will pay to apply 30 to 40 pounds more nitrogen. The fescue can be used during the winter months for grazing and in the spring fescue and clover will be back in a 50-50 combination.

Fescue and white clover will give approximately 200 days of grazing beginning in November and ending in June. Fescue should never be grazed shorter than 3 to 4 inches as serious overgrazing will kill it out. Newly planted fescue should be allowed to grow to a height of 6 inches before it is grazed the first fall or spring and then not grazed continuously the first year to give it a chance to come back each time following grazing until it gets well established. If, for some reason, there is a poor stand of fescue

Fig. 6. Excess pasture can be stacked and used for winter feed.

and clover the first fall and replanting is needed, do not replant in the spring. Sow 15 pounds of Kobe or Korean lespedeza on the thin stand March 1, graze this during the summer, and replant the fescue and ladino in September or October. On well-established fescue and ladino 1 animal per acre during the winter period and 2 to 3 animals during March, April, May, and part of June make a good stocking rate.

Ryegrass and Crimson

Ryegrass and crimson make an ideal annual spring grazing combination. This combination should be fertilized with minerals in the fall using the following rates: 300 pounds superphosphate, 100 pounds muriate of potash, and 60 pounds nitrogen. Mixed fertilizer can be used, 500 to 600 pounds of 6-8-8 or 5-10-5 or 500 pounds of 0-14-14 per acre. Heavy grazing should be practiced on this combination during March, April, and May and the land can either be planted to a temporary crop such as Sudan or millet, or planted to cane for silage and put back into ryegrass-crimson again that fall. Some farmers like to fallow the area following annuals so early planting can be done that fall. A ryegrass and crimson combination should have 2 to 3 cows per acre during the early spring months until the plants start seeding out.

Dallis and White Clover

Dallis and white clover are a favorite combination in the South, the white clover being grazed off in the spring months and the Dallis in the summer and fall. Since this is a long-growing perennial combination, it will take about the following application of fertilizer to get it established: 500 pounds superphosphate, 150 pounds muriate of potash, and 32 pounds nitrogen. To keep Dallis and white clover good, apply the following fertilizer each year: 300 pounds superphosphate, 100 pounds muriate of potash, and 32 pounds nitrogen in the fall, or use 500 or 600 pounds of a mixture such as 0-14-14 plus nitrogen in June and late August.

Dallis grass will not stand overgrazing. In the spring the clover should be grazed heavily, but it will be better to graze heavily an area for a two-week period and give it a rest of two weeks, then the Dallis won't be grazed out. Dallis can be handled in one of two

ways in the summer. Either give enough area per cow so it will not be overgrazed, or divide the pasture and graze one area two weeks and change over to the other side for two weeks and so on back and forth every two weeks. Clip once each month or six weeks.

Dallis grass and white clover will give grazing from March to frost and the good pasture producer who has enough area to cut part of his winter hay for beef cattle out of the pasture in the summer will be practicing good pasture management. In June clip to get off all the weeds and tough grass and the next clipping, which will be in August, rake and bale or stack for winter feed.

It will have to be remembered that if Dallis is allowed to grow up high in the fall and not grazed down, white clover has a hard time getting through during the fall. These areas should be grazed down in September and October. If the area in Dallis is limited, a field joining the pasture can be planted in Sudan or millet and the cows grazed there a few hours each day to help out the Dallis pasture.

Dallis and Lespedeza

Another of the outstanding pasture combinations in the South is Dallis-lespedeza. This furnishes good pastures from April until frost, provided it is not overgrazed. As with the others, it needs an application of fertilizer each year and the following is recommended: 500 to 600 pounds of 0-14-14 or 300 pounds superphosphate and 100 pounds muriate of potash every fall.

It is not a good idea to mix Dallis, white clover, and lespedeza in the same pasture, as the white clover will choke out the lespedeza. It will be better to have two areas—one of Dallis-white clover and one of Dallis-lespedeza.

In establishing Dallis and lespedeza the first time, prepare a seedbed, apply the fertilizer, drill or harrow the Dallis in, cultipack, and sow the lespedeza on top of the ground in March. This area should not be grazed until the Dallis gets well established, which will be when it seeds out the first time. This can be handled in one of two ways: A good cutting of hay from the first growth, or livestock can be turned in to graze it off. Never graze Dallis until it gets well established and never overgraze it.

Oats, Wheat, Barley

Oats, wheat, and barley are seldom grazed in the spring except where hogs graze off the grain. These cereals are outstanding grazing crops for fall and early winter. If they are not planted with a legume or clover, they can be interplanted with lespedeza in March, grain cut from the cereal, and either hay or grazing gotten during the summer from the lespedeza, and then oats or other cereals planted that fall. This is usually on cultivated land.

Another practice which is gaining popularity in the South is to seed oats in pasture sods such as Dallis and Bermuda in October and graze this off in the spring along with other pasture grasses and clovers. It gives a firm place for the cows to graze in the winter and if the proper amount of fertilizer is used, it will give good growth in the sod and not too much damage will be done if not seriously overgrazed. Drill at time of planting 600 pounds of 6-8-8 or similar mixture and topdress later with 30 pounds more nitrogen.

Sericea lespedeza which has been planted and become established is being interplanted with crimson for spring grazing and it has been found that it is better to graze the crimson off rather than try to harvest seed from it in the sericea. Crimson left for seed in the sericea chokes it out, while grazing helps the sericea come on out in the spring.

Bermuda Grass

Coastal Bermuda is becoming popular in the South, and management plus

the right amount of fertilizer is important. Coastal Bermuda is a good dry-weather, sandy and clay soil plant. It can be used with clovers or alone.

A topdressing of mixed fertilizer such as 6-6-12 or 10-10-20 along with extra nitrogen is the secret of good growth. For grazing, Bermuda can use up to 200 pounds of nitrogen during a growing season. It is a little different from most grasses in that it uses 2 pounds of K_2O to every 1 pound of P_2O_5. Coastal Bermuda uses plant food from the beginning of the growing season to the end—especially nitrogen.

Kudzu

Kudzu is a good summer grazing crop and can be grown on land too rough to grow row crops or even pasture crops. Kudzu will take care of gullies, stumps, and bushes. Grazing should be done during July, August, and September, but never heavily enough to stop all growth. It will pay to let the livestock in a few hours each day or put only enough in to graze down but not too close. One cow per acre all during the summer period or 2 or 3 cows per acre for two hours per day make a good grazing load.

Volunteer Plants

There are many thousands of acres of pastures in the South that will never be plowed or prepared for a seedbed. There is a way to improve this land without going into the complete pasture program. These areas are often growing volunteering pasture plants. The management practices that will pay big dividends are fertilizing and mowing.

It will pay to lime these areas if they need liming. A soil test will show the lime needs. Lime for a pH of 6.0 to 6.5. Fertilizers put out will do better if lime is used.

For easy application, use 600 pounds of 0-14-14 on pasture areas not to be seeded. Many states use a mixture such as 3-12-12 or 4-12-12. A thousand pounds per acre of this mixture will bring out the old pastures. Without seeding, the plants will be the volunteering ones such as Dallis, Bermuda, lespedeza, hop clover, and some white clover on the low places. Topdressing this fertilizer is a good practice if no seeding is to be done or erosion won't take off too much of the topdressed fertilizer.

Sometimes it takes good management to keep sods from getting so high that clovers such as white and crimson cannot come back in the fall. If heavy sods are left on the land, clovers will germinate and get choked out.

Summary

Many farmers look upon money put into mowing machines, clippers, spraying machines, silage cutters, and haying equipment as a cost on their pasture program. They should look upon it as an investment. When farmers make a business out of growing grass, they naturally want to invest all the money in it that will make a good return. They should study every way and place where more money invested will increase the return.

Fig. 7. A newly developed machine that sows small grain and seeds clover in established sods.

One of the most important parts of the pasture management program is re-fertilizing the pasture after it is put in. Oftentimes farmers feel that by using the amount of fertilizer necessary to establish a pasture, it will be several years before any more fertilizer is needed. But it has been found that the best way to keep a good pasture good is an annual application of a balanced fertilizer. If too much of one plant food element is applied on the pasture and another left off, the grass and clover get out of balance.

The following must be remembered about pasture management:

1. No pasture will produce the most without proper management.
2. Overgrazing will generally reduce the grasses and increase the clover.
3. Undergrazing will generally reduce clover and increase grasses.
4. Proper management practices will maintain a balance of about 50% grass and 50% clover.
5. Hay, silage, and winter grazing should be provided so that the permanent pastures will not be overgrazed during late fall, winter, and early spring.
6. Ladino clover mixtures should go into the winter with 6 to 8 inches of growth. Let them grow to 6 to 8 inches in the spring before grazing.
7. If clover has thinned out or grass is taking over, grazing should start early in the spring. Do not let the grass get over 3 or 4 inches high at any time. Clip to give the clover a chance to grow.
8. If the grass is thinning out, let pastures grow to 12 to 15 inches tall in the spring before grazing. Better still, let the grass reach the stage for hay or silage and cut it for that purpose.
9. Let a good growth of grass accumulate in August and September, the critical time for grasses. Overgrazing at this time will injure the stand.
10. Fertilizer topdressed in spring or early fall will help increase grasses.
11. If clover is thinning out, keep grasses grazed or clipped reasonably close at all times. Unless the plant food is maintained by frequent topdressings, the grasses will use the available potash and cause the clover plants to thin out from potash starvation. Grasses use a lot of potash.
12. Rotational grazing is best for ladino clover mixtures.
13. Tall bunches of ungrazed grass should be clipped immediately after removing cattle from pasture, or 2 or 3 days before. Harrowing to scatter droppings is also a good practice.

Science . . .

(*From page* 5)

It is our job to burn away the barriers that exist between the laboratory and the field. This requires a torch heated to the white heat of resolution. Sometimes the scientist himself makes the task no easy one.

When he says *Agropyron Repens,* I mean quackgrass. When he claims it is *Medicago Sativa,* I insist it is just alfalfa. When I sketch a butterfly, he points out my errors in dimensions and calls it one of the *Lepidoptera.* When I rhapsodize on my primrose by the river's brim, he scans his catalog and remarks, "A case of *Primula Vulgaris.*" He measures the cadences of the *Ranis Catesbiana,* but I only hear the croaking of the bullfrog. He wants strict adherence to precedent and a

multitude of Latinized family traditions, while my aim is to live and move and have my being. He wants to stand or fall by the grace of past bibliographies and the hope of future libraries. My task is to make hay while the sun shines and get into the shade as soon as possible. Outwardly, a union of purpose between us seems like running Al. Smith and Bill MacAdoo on the same ticket. Like the poles, we are far apart, but the future of the whole world, after all, lies between us.

Whenever I see that famous picture, "The Man With the Hoe," showing a creature bound down by sodden ignorance and incessant toil, my mind at once visions the Labor Unions and the shorter hours of this present age by way of alleviating contrast. From this I at once grasp the truth that Labor Unions have been able to demand shorter hours and better working conditions largely because of what Science has manifested and the world has utilized.

Labor is productive and happy only as it is guided by trained intelligence. The trained intelligence of scientific forces has endowed mankind with his marvelous control of stupendous powers and facilities.

It has opened new stores of raw wealth, has synthesized thousands of new compounds, supplied the working data to build complex machines and revolutionary processes to emancipate those who toil and give them more welfare with less hardship and more leisure. In the industrial laboratory it has perfected tools of precision and has provided "thinking apparatus" which we have learned to call "robots."

In the realm of pain prevention and the lengthening of life, science has taken equally wonderful strides. It has mitigated the horrors of surgery and removed much dread from disease by the blessings of anesthesia, antisepsis, anti-toxin, insulin, thyroxin, and adrenalin; and its noble fight against yellow fever, tetanus, diphtheria, typhoid, and tuberculosis has made our world ten thousand times more livable and lovely.

AT one time man measured his wonders and his world's greatest marvels by their size or by the grandeur of the dynasty that built them by the blood and sweat of slaves. Those things included the pyramids, the hanging gardens of Babylon, and the Colossus of Rhodes, the Great Wall of China, and the Columns of Karnak.

In our happy days we seek our marvels through the eye-piece of the microscope, and the molecule, the atom, and the electron appear as mightier and more dominating elements than tons of brick and mortar heaved into place by dull despair under the lash of despotism.

It is true that we train the soldier and fashion larger cannon, but the science of war-prevention is looming up on the world's horizon, hand in hand with the final cure for cancer and the elimination of narrow prejudice. Mark me, it will be the scientist who plays the stellar role in that drama, and not the politician.

Impatience is in me at this moment when I contemplate the negative part played by science in assuming leadership on public questions. Science has knowledge without power, and politics has power without knowledge.

Timidity, academic prudence, diffidence, or whatever you may call it, seems to bar the average scientist from active participation in anything closely approaching political economy. Cloistered amid the test tubes that regenerate and revitalize the world, sequestered in the classroom with callow

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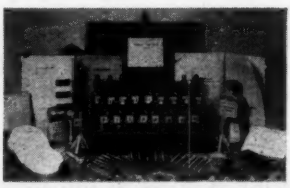

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youth, he is the very embodiment of both liberalism and conservatism. The pedagogue draws into his shell and lets the demagogue have his fretful way unchallenged. Marconi invents the wireless and Bill Thompson uses it to reach all who have radio sets at a dollar down and a dollar a week!

Government by gullibility and propaganda will never give way to government by intelligence, fact, and good will as long as science is satisfied to be serviceable only. I know the Dean of an agricultural experiment station who might have been in the national cabinet, but he told me that he would not be happy in the associations and connections of life at Washington. He was afraid of possible ridicule and the lurking joker in the deck of democracy.

SCIENCE, as I want it to be, must be militant. It must reach out and help us guide the hands of those to whom it entrusts the mighty powers which the laboratories donate to the world.

Here, at this point, is the place where religion enters—the religion of a square deal, the religion of race development, the religion of the open mind. Here is a good place to emphasize my meaning by a quoted passage from a former president of The Society of Chemical Engineers, who says:

"If the heavens declare the glory of God, that glory is more manifest by telescope and spectroscope. If the whirling nebulae and the stars in their courses reveal Omnipotence, so do the electrons in their orbits reveal His Presence in universes brought into being by the striking of a match. The laboratory may be a temple as well as the church. The laws of nature are the Will of God, and their discovery is a revelation as valid as that of Mount

Sinai, and by their observance only can man hope to come unto himself and be in harmony."

THERE are two classes of men upon whom light must be shed. I am not in a position to do the "shedding," but they ought to be reformed.

One of these groups values science only for the mean and material benefits it confers. Speed, service, comfort, and coin—these are the graduating classes he uses to mete out his driblets of praise for science. In other words, science exists to magnify the ego.

The other class is made up of iconoclasts and atheists. They seek to prove that all of man's spiritual ideals are table-rapping mysticisms that may be exploded when the arc light of science is turned upon the tricky medium! He tries to bring the faith of our fathers into his own chaotic state by references to scientific research. To the unguarded and the uninformed, his spell is hypnotic and his harangue is dangerous.

When I am beset with men of his kind I try to recall the mental picture I have of two mighty men of science in my college town. One of them is a chemist of international fame, who leads a Bible class. The other is a biologist of note, who often occupies the pulpit. Like Alexander Pope, they know full well that "a little knowledge is a dangerous thing; drink deep, or taste not the Pierian spring." They and others like them have been drinking those healing waters for many years, and still Nature's Niagara rushes on unspent and furious. At least, there is plenty of it left to drown the doubters.

I began by offending a scientist. I hope that I have not ended by offending you!

Left—untreated onion; Right—treated with MH-40

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THE AMERICAN POTASH INSTITUTE

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In a crowded bus a lanky Kentuckian sat opposite a young woman whose skimpy skirt kept creeping over her knees. She tugged at it constantly in an effort to maintain her modesty, but to no avail. At length, she looked up and met the gaze of the Kentuckian.

"Don't stretch your calico, sister," he drawled. "My weakness is whiskey."

* * *

Following epitaph is on a headstone in the Medway, Mass., cemetery:

In Memory of Mr. Peter Daniels
1688-1746

Beneath this stone a lump of clay,
Lies Mr. Peter Daniels,
Who too early in the month of May
Took off his winter flannels.

* * *

Man to friend: "Nobody can cook like Mabel, but they came pretty close to it when I was in the Army."

* * *

It's getting to the point where small children may have to be educated to realize that "damn" and "taxes" are two words.

* * *

A mother, her arms filled with groceries, got on a bus with her daughter, age five. The little girl had the fare and dropped it in the fare box, then seemed to feel that a word of explanation was in order. "I'm paying the money," she told the driver in a voice clearly audible at the back of the bus. "My mother is loaded."

The young lawyer was amazed to see Old Dan from the back hills, standing on the railroad platform with his Bible under his arm. "Why, Uncle Dan," he asked, "where on earth are you going?"

"Done read about them places down in Nashville," the old man chuckled. "Dancing girls, fiddlers, and bright lights—I'm agoin' to see for myself."

"But why the Bible?" asked the puzzled lawyer.

"Well, if it's as good as I'm a hearin'," Old Dan replied, "I'm a-aimin' to stay until Sunday."

* * *

Golf is a game in which a ball 1½ inches in diameter is placed on a ball 8,000 miles in diameter. The idea is to hit the smaller ball.

* * *

On a trip to town, the small girl took her new dog into a grocery store.

Grocer—"My, that's a fine dog you have there, Janie. If she has puppies, will you save one for me?"

Janie—"I'd love to, but Lassie won't have any puppies. She's already had her tonsils out."

* * *

"I can't marry you," said the justice of the peace. "If this girl is only seventeen, you will have to have her father's consent."

"Consent!" yelled the groom-to-be. "Say, who do you think this old guy with the rifle is, Daniel Boone?"

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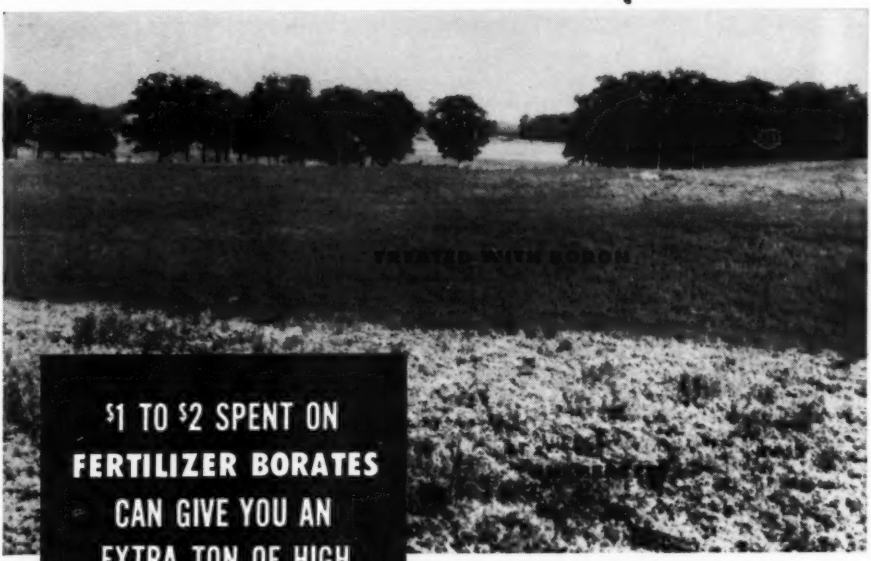

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